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PHYSICAL ANTHROPOLOGY OF EUROPEAN POPULATIONS

WORLD ANTHROPOLOGY

Physical Anthropology of European Populations

World Anthropology

General Editor

SOL TAX

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Physical Anthropology of European Populations

Editors

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General Editor's Preface

On the European continent, "anthropology" is generally understood as the study of man physically, past and present, as distinguished from ethnology, folklore, linguistics, and other "cultural" branches. Even so, it is exceedingly broad, comprising human evolution and genetic and environmental variations within and between populations. These studies had an early start in Europe, from medicine and from interest in the origins and interrelations of local and national populations. Later additions were studies of individual development and of processes underlying human variation and the interaction among physical types. Concern with the evolution of *Homo* and the prehistory of the species remained, in Europe, largely separate from physical anthropology, though often pursued by the same institutions and scientists. Thus, disciplines like primatology, paleoanthropology, and problems in human biology, ecology, adaptation, and evolution tend in Europe to parallel rather than to overlap physical anthropology. European anthropologists pursue their special problems in all parts of the world; but the present book describes recent work only in and near to Europe itself. To "place" these studies in the broader framework of European research on European populations, the editors provide a brief survey of current research, country by country.

Like most contemporary sciences, anthropology is a product of the European tradition. Some argue that it is a product of colonialism with one small and self-interested part of the species dominating the study of the whole. If we are to understand the species, our science needs substantial input from scholars who represent a variety of the world's cultures. It was a deliberate purpose of the IXth International Congress of Anthropological and Ethnological Sciences to provide impetus in this direction. The *World Anthropology* volumes, therefore, offer a first glimpse of a human science in which members from all societies have played an active

role. Each of the books is designed to be self-contained; each is an attempt to update its particular sector of scientific knowledge and is written by specialists from all parts of the world. Each volume should be read and reviewed individually as a separate volume on its own given subject. The set as a whole will indicate what changes are in store for anthropology as scholars from the developing countries join in studying the species of which we are all a part.

The IXth Congress was planned from the beginning not only to include as many of the scholars from every part of the world as possible, but also with a view toward the eventual publication of the papers in high-quality volumes. At previous Congresses scholars were invited to bring papers which were then read out loud. They were necessarily limited in length; many were only summarized; there was little time for discussion; and the sparse discussion could only be in one language. The IXth Congress was an experiment aimed at changing this. Papers were written with the intention of exchanging them before the Congress, particularly in extensive pre-Congress sessions; they were not intended to be read aloud at the Congress, that time being devoted to discussions — discussions which were simultaneously and professionally translated into five languages. The method for eliciting the papers was structured to make as representative a sample as was allowable when scholarly creativity — hence self-selection — was critically important. Scholars were asked both to propose papers of their own and to suggest topics for sessions of the Congress which they might edit into volumes. All were then informed of the suggestions and encouraged to rethink their own papers and the topics. The process, therefore, was a continuous one of feedback and exchange and it has continued to be so even after the Congress. The some two thousand papers comprising *World Anthropology* certainly then offer a substantial sample of world anthropology. It has been said that anthropology is at a turning point; if this is so, these volumes will be the historical direction-markers.

As might have been foreseen in the first post-colonial generation, the large majority of the Congress papers (82 percent) are the work of scholars identified with the industrialized world which fathered our traditional discipline and the institution of the Congress itself: Eastern Europe (15 percent); Western Europe (16 percent); North America (47 percent); Japan, South Africa, Australia, and New Zealand (4 percent). Only 18 percent of the papers are from developing areas: Africa (4 percent); Asia-Oceania (9 percent); Latin America (5 percent). Aside from the substantial representation from the U.S.S.R. and the nations of Eastern Europe, a significant difference between this corpus of written material and that of other Congresses is the addition of the large proportion of contributions from Africa, Asia, and Latin America. "Only 18 percent" is two to four times as great a proportion as that of other

Congresses; moreover, 18 percent of 2,000 papers is 360 papers, 10 times the number of "Third World" papers presented at previous Congresses. In fact, these 360 papers are more than the total of *all* papers published after the last International Congress of Anthropological and Ethnological Sciences which was held in the United States (Philadelphia, 1956).

The significance of the increase is not simply quantitative. The input of scholars from areas which have until recently been no more than subject matter for anthropology represents both feedback and also long-awaited theoretical contributions from the perspectives of very different cultural, social, and historical traditions. Many who attended the IXth Congress were convinced that anthropology would not be the same in the future. The fact that the Xth Congress (India, 1978) was our first in the "Third World" may be symbolic of the change. Meanwhile, sober consideration of the present set of books will show how much, and just where and how, our discipline is being revolutionized.

Readers of the present volume will be particularly interested in other volumes of *World Anthropology* which treat other aspects of European anthropology; physical anthropology in other parts of the world; and primatology, paleoanthropology, archaeology, and regional aspects of the disciplines.

Chicago, Illinois
August 10, 1979

SOL TAX

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Introduction

ILSE SCHWIDETZKY

The papers on physical anthropology of European populations sent to the ICAES in Chicago were not representative of current research work in Europe: not all the European physical anthropologists interested in this field came to the Congress and/or sent papers for publication; many departments and whole countries were not represented; and many papers on the biology of local populations were allocated to other sections and have been published in other volumes of the *World Anthropology* series. The editors of this volume decided therefore to add an introduction to the Congress papers published here which would give a survey of recent and current research work on European populations in the different European countries and therewith a background to the contributions which follow.

The survey is based on information given by many European physical anthropologists[1] who replied to a circular letter. Only those papers or research projects have been considered of which reports or summaries

This introduction, written at the end of 1973, was designed to be a survey of current physical anthropological research work on European populations. Unfortunately it could not be brought up to date when printing was started (1979). The introduction should therefore be taken as a paradigma of a five-year period of European research activities.

[1] V. P. Alekseev, Moscow; N. A. Barnicot, London; B. Chiarelli, Turin; T. S. Constandse-Westermann, Utrecht; V. Correnti, Rome; R. Denisova, Riga; H. Dolinar, Ljubljana; A. W. Eriksson, Helsinki; K. Ery, Szekesféhervár; F. Facchini, Bologna; D. Ferembach, Paris; A. G. Gadžiev, Machačkala; Ž. Gavrilović, Novi Sad; J. Huizinga, Utrecht; H. W. Jürgens, Kiel; J. B. Jörgensen, Copenhagen; D. Kadanoff, Sofia; I. Kiszely, Budapest; G. Kurth, Braunschweig; A. Leguebe, Brussels; P. Lipták, Szegéd; C. Maxia, Cagliari; P. Messeri, Florence; P. Moeschler, Geneva; O. Necrasov, Iasi; G. Olivier, Paris; J. Pálsson, Reykjavik; R. Parenti, Pisa; J. Pons, Barcelona; A. N. Poulianos, Athens; D. F. Roberts, Newcastle; W. Scheffrahn, Zürich; H. Schmidt, Bucharest; W. Steşlicka-Mydlarska, Wrocław; M. Stloukal, Prague; J. Suchý, Prague; J. Torgersen, Oslo; F. Twiesselmann, Brussels; G. N. van Vark, Groningen; H. Walter, Bremen; M. Weninger, Vienna; N. Xirotiris, Thessaloniki.

could have been given at the Chicago Congress, i.e. those concerning research work of approximately the five years ending in 1973.

Unfortunately it was impossible to include all the information given by the contributors. The survey focused on local populations, on their structure and differentiation, on regional and ethnic differences, on problems of ethnogenesis and ethnohistory as revealed by physical-anthropological data. Recent populations as well as historical populations represented by skeletal remains were considered. Other more general problems of human biology, such as growth, the evolution of *Homo sapiens*, race classification, genetics of normal characteristics, general population genetics, and the physical anthropology of non-European populations, are only mentioned briefly if they play a large part in the physical anthropology research of the respective countries. But it was also impossible to use all the information on the main subject. In general, studies on one variable in one sample (for instance, AK in Norwegians or cephalic index in students of University X) are not mentioned.

The author of this introduction was responsible for the selection of topics and titles. She tried to give a fair survey, to consider at least the most important and representative studies, and to bridge some gaps in direct information by citing the applicable literature (which, however, she does not know perfectly!).

In the following survey the information is arranged by country, but first some supranational European projects must be mentioned. At the VIIIth ICAES in Tokyo, 1968, a meeting of European physical anthropologists was held. The participants decided not to found a new organized society with inscription of members, statutes, fees, and so on, but to form a working group to intensify communication and to encourage common research work. Correnti, from Rome, Mrs. Necrasov from Jassy, Romania, and Mrs. Schwidetzky, from Mainz, were elected as speakers of this group. A second meeting was held in Mainz in October, 1969. Its main subject was the data bank on prehistoric physical anthropology of Europe and neighboring countries, whose start was supported by the Wenner-Gren Foundation. It was built up during the next few years in Mainz in collaboration with the Banque Néolithique of the Anthropological Institute in Geneva (M.-R. Sauter 1973) and with the help of many members of the European working group (Schwidetzky 1972a). In 1975 the decision made in Tokyo was revised and the European Anthropological Association founded; it held its first meeting in Zagreb in 1977 with G. Olivier, from Paris, as president, and B. Chiarelli, from Turin, as general secretary. The European Anthropology Newsletter, compiled by Ch. Susanne, from Brussels, is distributed among the members.

A survey of physical-anthropological teaching and research in the western European countries is given by the papers of the 8^{e} Colloque de

l'Association anthropologique internationale de la Langue française, Bruxelles 1972, edited by Leguebe (1973). There are, furthermore, two voluminous publications based on the collaboration of many European physical anthropologists: (1) *The physical anthropology of the Neolithic* (Schwidetzky, editor, 1973, 1978) with contributions on all European and some neighboring countries. (2) *The racial history of mankind* (founded by K. Saller, edited since 1974 by Schwidetzky) dedicates 5 of its 12 volumes to Europe. The first European number contains contributions on Great Britain and Ireland (Brothwell), France (Vallois and Chamla), the Iberian peninsula (da Cunha), and Italy (Passarello); the second on the European part of the Soviet Union and Finland (Bunak), the Scandinavian countries (Torgersen) and Iceland (Pálsson); the third on Austria (M. Weninger), Czechoslovakia (Jelinek and Suchý), and Poland (Wierciński, Gładykowska-Rzeczycka, Bergman, Bielicki and Sawicki); the fourth on Hungary (Kiszely), Romania (Necrasov), Bulgaria (Boev and Schwidetzky), Yugoslavia (Gavrilović and Schwidetzky), Albania (Schwidetzky) and Greece (Xirotiris); the fifth number covers Switzerland (Sauter), Germany (Schwidetzky), Belgium and Luxemburg (Twiesselmann) and the Netherlands (de Froe and Schwidetzky). Thoma's article (1970) is also European in orientation.

Some further remarks on the papers which follow this introduction: several contributions on "White Africa" are included, but the survey below considers only European countries. Since papers on the physical anthropology of European populations were to be found in other sections of the Congress, the editors tried to obtain some of them. Several authors agreed to this editorial proposition, others refused. Although Congress papers could be published in more than one volume of the *World Anthropology* series, the editors have preferred to omit those papers whose authors preferred other volumes for publication. The picture of what the Congress offered on physical anthropology of European populations is expanded by the list of abstracts in the Appendix to this volume.

The following report on recent and current studies on local European populations is arranged in alphabetical order by country. No information could be obtained (and probably no research work has been done) from Albania, Andorra, Liechtenstein, Luxembourg, and Monaco, which therefore are not mentioned below.

AUSTRIA

No information on living populations has come in, except a study of dermatoglyphics in a Vienna sample (Weninger 1975) and some papers on single serogenetic variables in one sample.

The earliest sample from prehistoric populations was yielded by a late

Lengyel cemetery near a hornstone mine; it matches well with the other remains of the Lengyel culture known from Austria (Jungwirth and Strouhal 1970; for another Lengyel skeleton, see Jungwirth 1973b). Jungwirth and Kloiber (1973) give a survey of the Neolithic skeletal remains after critical revision of datings. Weninger (1978) has surveyed the physical anthropological history of the country for *The racial history of mankind* (mentioned above). The remains of some historical personalities and remains from church graves are also described by Jungwirth (1971, 1973a).

BELGIUM

There are several very active centers of human biology in Belgium. But the problems in which they are particularly interested, such as evolution of man, assortative mating, growth, heritability, etc., are not considered in this survey. However, a new survey of measurements and pigmentation is available, based on 2,222 twenty-year old males from seventeen regions (Sporcq 1969); some regional and ethnic differences have been confirmed, but gradients are very weak.

Two new samples of dermatoglyphics with a tabulation of earlier studies should be mentioned (Vrydagh-Laoureux 1970, 1971). The ABO structure of the Belgian population has been restudied on the basis of earlier published materials; Malecot's theory about the decrease of kinship with distance was tested and differences between Flemish and Walloon confirmed (Dodinval 1970).

Some local populations from prehistoric and historic periods have been studied in recent years. Studies on the first human remains from the Iron Age and from Roman times in Belgium have been published (Delsaux 1970, 1973). The Franc populations are better represented. One of the largest cemeteries is that of Coxyde, subject of several earlier papers. Recently the long bones have been studied (Orban 1970), and the well-preserved skeleton of an achondroplastic dwarf from Coxyde has been comprehensively studied by Susanne (1970). A survey on the physical anthropology and physical history of the Belgian population was prepared by Twiesselmann for *The racial history of mankind* (see above).

BULGARIA

The physical anthropological section of the Institute of Morphology of the Bulgarian Academy of Science began to study the non-Bulgarian "small populations," such as Tatars, Gagausians, Armenians, and Turks, which are to be found particularly in the northeast, the Dobrudsha. A

first paper (Tzacheva et al. 1974) treats the Tatars, who came to Bulgaria in two immigrations, one in the thirteenth century and one in the nineteenth. Their reproductive isolation from the Bulgarian population is complete. There are considerable differences between Tatars and Bulgarians of the same region, pointing at the eastern (Mongoloid) origin of the Tatars. Another Tatar group was examined by a Hungarian anthropologist (Henkey 1972). The main Bulgarian population is represented by a sample from the Pleven region (metrical characteristics: Bojadžijev 1970). Of several serogenetic studies on Bulgarians, that of Walter, Ananthakrishnan, and Tsacheva (1972; Hp, Gc, Tf, Gm, InV) may be mentioned. Boev (1972b) gave a survey on everything done concerning the physical anthropology of Bulgaria, particularly on prehistoric populations. Human remains from early Neolithic times suggest a continuity of the population. The first distinct ethnic group known from Bulgaria is the Thracians. Boev (1970, 1972b) compiled the sparse existant data on their physical appearance, from human remains as well as artistic representations, and came to the conclusion that the recent population is similar to this ethnic stratum, despite later Roman, Slavic, and Old Bulgarian infiltrations.

There are some difficulties in the comparison of skeletal and living populations; therefore, a particular interest exists for large skeletal samples from recent times. Kadanoff et al. (1974) were able to study 1,510 crania from the military cemetery at Sofia, where soldiers and officers were buried during the wars 1912–1913 and 1915–1918. As the birthplaces of the deceased soldiers are known, this representative sample can be grouped by region and province. Thirty-one cranial measurements were taken; there are few regional differences, obviously fewer than in former periods. From a still larger sample of recent Bulgarian skulls epigenetic characters were also studied (Kadanoff and Mutafov 1970). The Bulgarian population seems to be very homogeneous, for the metrical characteristics at least, as previously suggested by R. Virchow (Kadanoff and Mutafov 1972).

CZECHOSLOVAKIA

Much work was done after World War II on physical development, which is not considered here; but some results are interesting for revelation of regional and ethnic variations and for knowledge of local populations, for instance those of the third whole-state investigation of youth in 1971 (Prokopec et al. 1973); and the studies on Gypsy youth (Malá and Suchý 1970, 1971); many earlier studies on adults, especially on stature, weight, cephalic index, and pigmentation, were compiled by Suchý (1972).

The study of prehistoric physical anthropology is very active in

Czechoslovakia. There are no less than five respective departments of museums which specialize in human remains. Paleodemography is well developed, as is paleopathology; a large paleopathological exhibition was organized by the anthropological department of the National Museum in Prague in 1970, which also visited western Germany (see Stloukal 1971, 1972; Vlček 1972; Vyhnánek 1972).

New findings of human remains begin with a Mesolithic individual of Mělnik; a report is now being prepared for publication by Vlček. The early Neolithic is represented by the Bandkeramic cemetery of Nitra (Slovakia), the largest cemetery of this culture known until now (for preliminary data, see Jelinek 1973). A critical survey of Neolithic and early Bronze Age remains from Moravia is given by Stloukal (1974a). These periods are represented in the other regions by skeletal findings of the Baalberg culture (Chochol 1970a), the Corded Ceramic culture (Chochol 1970b); the late Bronze Age Knoviz culture (Chochol 1972); and the early Bronze Age from Bajč in Bohemia (Hanáková and Stloukal 1973).

No new materials can be listed for the Iron Age and the Roman period, but some on the migration period from Vyškov in Moravia are published (Stloukal 1974b). The best-represented period is that of the early Slavs. For the famous Mikulčice, the capital of the old Moravian Empire, special studies on social differences (Stloukal 1970), on paleodemography (Stloukal this volume), and on spondylosis determined quantitatively (Stloukal et al. 1970) have continued earlier published material; new samples include those of Abrahám (Stloukal and Hanáková 1971), Bílina (Hanáková 1971), Lahovice (Chochol 1973), Libice nad Cidlinou (Hanáková 1969), Želovce (Stloukal and Hanáková 1974), and Nitra-Lupka and Pobedim (Thurzo 1969, 1972). These rich materials also permit special studies on ontogenetic development (Blajerová 1969), paleodemographic analysis, and pathology (Stloukal and Vyhnánek 1970; Stloukal et al. 1970; Vyhánek 1969, 1971). The transition to recent times is given by more than 800 skeletons from the church of St. Benedict in Prague, (twelfth to eighteenth centuries, now being prepared in the anthropological department of the Natural History Museum in Prague); Suchý (1972) compiled earlier materials of this kind.

DENMARK

As only earlier anthropometric data are available for Danes, Pálsson (1974) studied a sample of young Danish males for comparison with Icelanders. Much work is being done on serogenetic traits, particularly enzyme polymorphisms, but predominantly for only one Danish sample and single variables (Lamm 1968; Sørensen 1972).

Skeletal remains are being collected and elaborated in the Universitetets Anthropologiske Laboratorium, Copenhagen; Jörgensen and his staff are working with a continuation of the "prehistoric man in Denmark", the first part of which, on Mesolithic, Neolithic, and Bronze Age men, has already been published in 1956. Jörgensen (1973) gives a short resurvey of Neolithic remains, including a new find from the Single-Grave culture. The small number of Mesolithic skeletons has been increased by the Melby find (Hansen et al. 1972), a small robust man and the first brachycranial individual in Denmark, which in Neolithic times had a high proportion of brachycranial skulls and seems to have been an early center of brachycranization. The famous brachycranial Borreby skulls, parents of a much-used (and misused) Borreby-type or Borreby-race, have been comprehensively discussed by Gerhardt (1969b); the type is a conglomerate.

FEDERAL REPUBLIC OF GERMANY

Studies on local population samples have not been the main interest of German physical anthropologists since World War II. Anthropologists who are interested in all-round studies on local human populations, their structure, and their ethnic differences prefer to go to Africa, southern Asia, or the Near East. Schaeuble in Kiel, together with Helmuth, organized a survey of the population of Schleswig-Holstein, where recruits from all parts of the country were studied; the data are being prepared for publication by Helmuth. After a survey on Westfalia, the staff of the Department of Anthropology at the University of Mainz (Bernhard, Klenke, Knußmann, Schwidetzky, and Walter) started a survey on the population of Rheinland-Pfalz, whose subjects were, like those in Westfalia, fourteen-year-old pupils from all parts and all social groups of Rheinland-Pfalz. Serology and dermatoglyphics were included, the former for only a smaller sample of the autochthonous population. The multivariate analysis showed a greater similarity between the populations of the Rhine Valley on the one side and the more mountainous regions on the other (Schwidetzky 1972c).

Many papers on serogenetic characteristics have been published, generally for single variables using one sample only. For the more comprehensive studies, one on a northern and one on a southern subpopulation, see Brinkmann et al. (1971): AP, PGM, AK, ADA, 6-PGD; and Arndt-Hanser and Walter (1972): sixteen systems.

The famous Ofnet finds have been redated by the collagen technique; they seem to be older than earlier supposed (13,100 ± 100 B.C.) (Glowatzky and Protsch 1973), and their morphology, which shows the beginning of gracilization and brachycephalization, is all the more

remarkable. Asmus (1974) has at her disposal remains from the Neolithic period of Corded and Aunjetitz peoples from Silesia. There is only one other new Neolithic individual, belonging to the Rössen culture (Czarnetzki 1972). Some Bronze Age remains have been studied by Kurth et al. (1972). The most comprehensive study of recent years is that of Ehrhardt and Simon (1971), who collected human remains from the Hallstatt period in southwestern Germany and compared them with other samples; more remains from the Hallstatt and La Tène periods will be published by Ziegelmayer of Munich and his students. Studies on two large and several smaller samples from Frank cemeteries have been published (Rösing 1975) or are being prepared for publication. Gerhardt making multivariate comparisons for seventy-one samples from the early and later Middle Ages (1969a) has restudied skulls of this period from southern Germany. Roth-Lutra (1974) considers twenty-nine samples from the Federal Republic; an eastern and a western population cluster can be distinguished as in earlier periods (Schwidetzky 1972b).

Henke (1972) has restudied the remains from the cemetery of St. Gertrud in Kiel (1350–1571). The sample fits well into other North European populations; there is a within-group variation between a gracile leptoprosopic and a robust euryprosopic type. The same is true for the remains from the cemetery of Langd near Gießen (ca. 1460–1860; Keil 1970). Preuschoft and Schneider (1969) published a study of skeletal remains of the ninth through nineteenth centuries from Würtemberg.

FINLAND

The most comprehensive study of a local population in recent years is that of the Skolt Lapps carried out by the Scandinavian IBP/HA group (Lewin and Eriksson 1970). In addition to a comprehensive medical and physiological study of this subarctic though no longer strictly isolated people, data on many normal variables and on other Lapp, Finnish, Finno-Ugrian, Scandinavian, and arctic peoples are included for comparison; for instance, anthropometry (Lewin and Hedegård 1971); dermatoglyphics, which fit into the European range, except the patterning of the palmar hypothenar, which is rare, as in Mongoloids (Lehmann et al. 1970; Saatman 1971; Schmitz 1971); PTC tasting, which shows a high frequency of nontasters (Eriksson et al. 1970); haptoglobine subtypes (Ehnholm and Eriksson 1969); hemoglobin and lactate dehydrogenase variants; C_3 types (Arvilommi et al. 1973); and PGM (Eriksson et al. 1971).

Another project has been started for the Åland Islands. In the first phase of a long-term study, the rich genealogical and demographic records will be analyzed. From 1800 to 1849, Eriksson et al. (1973) have

shown a strong reproductive isolation of the island populations and the relation between marital and geographical distance.

The Finnish mainland population has been included in a comprehensive study by Mark (1970) on Finno-Ugrian peoples. She studied ten local samples of Finns for measurements, pigmentation, and descriptive features, confirming the physical-anthropological differences between the western and eastern parts of Finland. She also discusses the ethnogenetic problems of Finns and Lapps in connection with prehistory and skeletal remains. Eriksson (1973) did a survey on monogenetic polymorphisms (see also Chazanova 1971; Nilsson and Eriksson 1972). The Finns have many rare genes, in which they deviate from other European populations; but it is not certain whether this phenomenon reflects eastern contacts, since for most polymorphisms only one Finnish sample is available and little is known on regional differences within the Finnish population. Finnish dermatoglyphics have been studied by Chit' (1969).

FRANCE

France is one of the two European countries (the other is Poland) for which a physical anthropological survey has been finished and published in the last five years. For France it has also already been statistically elaborated, and regional differences have been considered (Olivier 1970; Chabeuf et al. 1973). The survey is based on recruits; the following characteristics were recorded (unfortunately, in some cases by persons who were only briefly trained by the physical anthropologists): thirteen measurements; eleven descriptive characteristics, including pigmentation and dermatoglyphics; six serological characteristics; and eight "physiological" characteristics, including PTC tasting, color vision, and IQ. The provinces are compared by several multivariate methods; regional differences are quite marked, and there are relationships with older typological classifications of the French subpopulations. As the French anthropologists have data from earlier surveys at their disposal, diachronic comparisons for the last hundred years are possible; there are many changes not only in the averages and distribution of stature and the cephalic index, but probably also for pigmentation (Vallois and Chamla 1974), as is also shown for Poitou families (Billy 1970, this volume).

The data from this survey have also been used to study social differences, for instance between rural and urban, agricultural and nonagricultural groups, professions of different intellectual level, etc., which might be partially genetically determined (Olivier 1974; Olivier and Bressac, this volume). There are several studies on local populations. Engel (1969, 1970), whose work is based on earlier studies on prehistoric/historic populations, comes (as does Billy for Savoie) to the conclusion that the

"Alpine type" has developed *sur place* from Mediterranoid populations. Finistère, the very isolated western part of Brittany, shows strongly endogamous local populations (Pée-Laborde 1969) with remarkable differences in serological characteristics (Saleun and Khérumian 1972a, 1972b). The island population of Corsica has also been studied (measurements, pigmentation, descriptive characteristics; Piquet-Thépot 1968).

With reference to prehistoric populations, Riquet's book (1970) on Neolithic populations must be mentioned first. It is based on the study and/or rearrangement of the French findings, summarized in some dozen tables; but comparisons and interpretations are extended to almost the whole of Europe, and diachronic comparisons hint at evolutionary trends such as gracilization and degracilization. Among newly discovered human remains must be mentioned the well-preserved Mesolithic young girl of Le Cheix (Vallois 1970; for a survey on Mesolithic remains from the Mediterranean area, see Ferembach 1973) and the Hallstatt tumulus of Chabestan, which yielded skeletal remains very rare in this period of predominant incineration (Billy 1968).

GERMAN DEMOCRATIC REPUBLIC

Much research work has been done on growth and maturation of recent populations, on normal variations of characteristics as a basis for the diagnosis of anomalies, and on problems of body build, constitution, and applied physical anthropology (Grimm 1973). Research work on local populations is scarce: Schott (1972, 1973a) used Virchow's survey (1886) on the pigmentation of German pupils to analyse differences between rural and urban populations (the tendency toward darker pigmentation in towns has been statistically confirmed) and between riverside areas and more distant zones along the Rhein, Danube, and Elbe (this hints at a more mixed population near the rivers). PTC (Schott 1969), dermatoglyphics (Hass 1969; Tammer 1971), and serogenetic traits (Grimm 1973) have been studied in some samples. The serogenetic investigation of Sorbic isolates has been continued (Geserick and Weiss 1971).

The main subjects of studies on local populations are skeletal remains from prehistoric and medieval times. They are really considered as population samples: Grimm, in Berlin, was one of the first physical anthropologists to plead modern views in prehistoric physical anthropology and the application of the population concept to skeletal remains. He himself is particularly interested in paleopathology as a hint at the social structure and way of life of prehistoric populations (see Grimm this volume).

Some samples have been large enough to add to the metrical and

morphological analysis aspects of population biology. Bach and Bach (1971) give a complete paleodemographic and paleopathological analysis; the geographic and ethnic situation of a Slavic cemetery, the arrangement and inventory of the graves and multivariate comparisons, give them many hints at the social structure and the mixture with the surrounding German populations. Another Slavic cemetery, that of Sanzkow (Mecklenburg), was chosen for detailed study as a contribution to an interdisciplinary project on the history and culture of Slavs in Germany (for the preliminary report with some paleodermographic and paleopathological data, see Ullrich 1969). Ullrich (1972), in addition to giving a detailed paleodemographic and paleopathological analysis, tries to distinguish kinship groups by polysymptomatic analysis and develops a hypothesis on the origin of the Aunjetitz population by comparison with other samples from Germany and Czechoslovakia (see also Schott 1973b). A detailed study on a Neolithic population by Bach and Bach (1972) must also be mentioned. Diachronic comparisons of all skeletal material from a part of central Germany point at a continuity of the population from Neolithic to Medieval times, except for the population of the Bell Beaker people (Bach et al. 1972).

GREAT BRITAIN

The last symposium of the Society for the Study of Human Biology (Roberts and Sunderland 1973) treated genetic variation in Britain, and the organizers were surprised at "how much work was indeed in progress." The studies focus on the marriage structure of local populations and the variations in the frequency of genetic characteristics, monogenic as well as polygenic. There are some main centers of local research work: (1) Northumberland, studied by the staff of the Department of Human Genetics at the University of Newcastle; historical records are being analyzed, gene-frequency surveys are going on, polygenic characteristics with high heritability (such as some dermatoglyphics; see Roberts and Coope 1972; and skin color) are being studied. (2) Oxfordshire, studied by Harrison and his colleagues in Oxford. Here the British research work on marriage patterns and marital distances in connection with geographic distance was begun (Boyce et al. 1971; Swedlund 1972), and the analysis of parish records, particularly in Oxford and Otmoor, is continuing (Boyce et al. 1971; Harrison et al. 1970; Hiorns et al. 1973). (3) The Orkney Islands (Boyce et al. 1973). The rate of endogamous marriages in twenty-eight parishes and the marital distances have been analyzed for the period from 1855 to 1965. In pigmentation the Orkneys continue the north–west cline of Great Britain; other characteristics show Orkneyan peculiarities probably due to isolation (Welsh 1973). (4) Urban popula-

tions are also being studied with regard to marriage patterns (Coleman 1973) as well as to biological variation in connection with social class (Wheatcroft 1973).

Kopeć (1970) has published the most complete survey of the ABO blood groups of the whole country. The north–south and west–east clines with lowest frequencies of A and highest of O in Scotland and Wales have been ascertained. Izatt (1973) continues her studies on the distribution of the Gm groups in Scotland and the north of England.

Study of the skeletal remains of prehistoric and historic populations is also going on, especially in the British Museum of Natural History. The biology of the British Neolithic population has been discussed by Brothwell (1973). The most abundant data are from the Anglo-Saxon period, and these have been analyzed most fully (Tattersall 1968). A critical compilation — critical particularly concerning dating — of the respective population samples is given by Brothwell (1974) who also tries, in connection with historical records on immigration and settlement, to give the outlines of the ethnohistory of Great Britain and Ireland.

GREECE

The period covered by this report begins with the third revised edition of Poulianos's book (1968) on the physical anthropology of Greece. The author (formerly a student of Debetz) collected data on fifteen measurements, pigmentation, and forty descriptive characteristics from about 2,600 male and female subjects from all over Greece living in the U.S.S.R., divided into six regions. Poulianos (1971) also studied the living population of Crete. Some west–east clines do not alter the overall picture, and the population seems to be rather homogeneous. Xirotiris (1971; Paidousis and Xirotiris, this volume) is studying the Pomacs, a socially isolated population in Thrace speaking a Slavic dialect, with special emphasis on metrics, serology, and dermatoglyphics. There are many papers on single variables. Valaoras (1970) has published data on the height and ABO blood groups of more than 300,000 conscripts distributed in fourteen regions. Several serogenetic traits, including ABO, MN, Rh, and Hp, have been studied by Fraser et al. (1969), Panagiotopoulos et al. (1970), and Schlesinger et al. (1971); color blindness by Pitsios (this volume); and dermatoglyphics by Weninger (1974) and Plato (1970).

Greece is very rich in remains of prehistoric populations. In a preliminary report, the remains from the Mesolithic and Neolithic layers of the Franchthi Cave are placed between Téviec and Natufiens (Angel 1969). The early Neolithic period is also represented by Nea Nikomedia in Macedonia (Angel 1973b); Lerna in the plain of Argos yielded remains

from the early Neolithic to the Roman period, among them a large population sample from the middle Bronze Age which could be divided into "clans" and studied for demography, pathology, and ecology as well as for morphology (Angel 1971). The shaft-grave "kings" from Mycenae are taller and more robust than their subjects and displayed enough wounds and fractures to show that they had been active and vigorous leaders (Angel 1973a). Ästrom and Eriksson (1972) made a special contribution to prehistoric physical anthropology; they studied fingerprints from old Greek clay objects, but the sample of 200 fingers, from an extended period and a large area, including Crete, seems not to be representative. Poulianos (1971) studied Cretan skulls from various periods and skulls of the Byzantine period from Prespa in Macedonia (Poulianos 1969; 1972). A study of an ancient Greek population from the Black Sea coast (Phanagoria) has been published by a Soviet physical anthropologist (Gerasimova 1971). It is very similar to other ancient Greek samples (Schwidetzky 1972b). Recently Xirotiris studied many museum materials from the Neolithic to the Byzantine period including paleodemography and paleopathology; he also wrote the chapter on Greece in the *Racial history of mankind* (see p. 3).

HUNGARY

The knowledge of the living population is still based mostly on data collected earlier. But current projects by Feher, Henkey, Nemeskéri, and others will yield new materials. Studies on measurements, pigmentation, and descriptive characteristics of some village populations have been recently published (Farkas and Lipták 1970; Kelemen 1968, 1972; Papp 1971). One of their main problems is the physical-anthropological effect of populations of eastern origin (see below), reflected in single Mongoloid features and the so-called Turanoid and/or Pamiroid types. Serogenetic studies are being performed independently; the most comprehensive of these studies, that of the Bodrogköz region, is reviewed by Walter and Nemeskéri (1972; see also Kelemen 1972 for Sárrétudvari; Walter and Nemeskéri 1969 for two villages of the Hegyköz northeast of Bodrogköz on the background of marital structures; and Nemeskéri 1974).

Much research work is being done on skeletal materials, which are unusually rich in Hungary. This research is favored by new methodical approaches, such as the "combined method" for age determination (Acsádi and Nemeskéri 1970) and the chemical sex determination (Lengyel and Farkas 1972). A record on all published findings up to 1968 is given by Éry (1968b). Neolithic sites of the Lengyel culture (Zengövárkony/Kom. Baranya, Villánykövesd, Ashod/Kom. Pest) have yielded many skeletal remains, studies on which have been published or

are being prepared for publication (Zoffmann 1968, 1969/1970). Tapé is a large cemetery of the late Bronze Age (Farkas and Lipták 1971). Information on the Roman period has also increased in recent years (Ery 1968a, 1973; Wenger 1968). From the German tribes which passed through Hungary or settled there in the first centuries of our era, the Langobards are the best represented by skeletal remains. Kiszely (this volume, 1973) collected them for a monograph, including also the Langobard remains from other countries. The large sixth-century cemetery of Környe cannot be attributed to a distinct ethnic group; paleoserological investigation resulted in much B (Lengyel and Toth 1971).

There is much new material from the Avar and early Hungarian period which is best known from the physical-anthropological point of view and which is especially interesting for Hungarian anthropologists (Bakay and Kiszely 1972; Bottyan 1971, 1972, 1973; Éry 1968b, 1970, 1971; Lipták 1968; Lipták and Marcsik 1970; Lipták and Vamos 1969; Lotterhoff 1971, 1973; Marcsik 1971; Wenger 1970, 1971). From one of these cemeteries blood groups have also been determined (Lengyel and Nemeskéri 1972); as in other bone samples from Hungary a very high percentage of B was found.

Several papers use the material from this early medieval period for comparative and ethnohistorical analysis. Lipták has given a comprehensive study of the ethnogenesis of early Hungarians (1970; Lipták et al. 1972). He discusses the origin of the Hungarians on the basis of their human remains and on the background of historical records, as well as on the basis of the physical anthropology of the related Old Bulgarians; his main method is interserial taxonomic analysis. Ery (1970) compares twenty-six samples from the sixth through twelfth centuries using multivariate distances. The differences between material of the Awar and of the Arpadian periods for males and females point at considerable immigration with an appropriate number of women.

ICELAND

The island character and the well-known population history may be the reasons that Iceland is much in vogue in physical anthropology. The autochthonous physical anthropologist Jens Pálsson continues the publication of his survey data on measurements and pigmentation; he compares with many other population samples to contribute to the solution of the problem of the origin of the Icelanders and supports his results by a statistical analysis of the *Landnámabok* ("The book of settlement"; Pálsson 1974); data on the variations according to endogamy/exogamy, age and social class, and rural and urban populations have also been published (Pálsson and Schwidetzky 1973a, 1973b, 1973c), and the

population census of 1971 has been used for the study of endogamy rates and migrations within the country (Henke 1973a, 1973b).

One of the main problems is that of the origin of the Icelanders: did the greater part of the colonists come from Norway as the *Landnámabok* tells us, or from Ireland? The second alternative seems to be supported by serological works (Bjarnason et al. 1973; Constandse-Westermann 1972; Walter and Pálsson 1973), which all point at the similarity of the Icelanders with Irish and Scottish people. Thompson (1973), on the basis of serological data, calculated the Norse contribution to the population of Iceland at 2 to 7 percent. But this is in contradiction not only to the *Landnámabòk*, archaeological findings, and the Scandinavian language and traditions of the Icelanders, but also to physical-anthropological data: measurements and particularly pigmentation of the Icelanders resemble more closely those of the Scandinavian peoples than of the Irish (Pálsson 1974; Pálsson and Schwidetzky 1973d).

In 1972 the Nordic Human-Ecological Research Group (supported by the Nordic Cultural Bond), in cooperation with the Anthropological Institute in Reykjavik, made anthropological and epidemiological studies on the population in Húsavik, a little town in the northeast of Iceland (for early data see Eriksson 1973; Pálsson and Schwidetzky 1973a). In 1972 and 1973, Pálsson, Henke, and Kandler collected physical-anthropological data on 1,200 people from Arnessýsla in southern Iceland. Also in 1973, Pálsson organized and directed two anthropological expeditions to northeastern Iceland, where 1,000 people from rural areas were investigated. This was partly a continuation of the Húsavik research project which, under the title "The Icelanders in the Changing World," was accepted as a part of the UNESCO "Man and his Biosphere" program and will be continued in the future.

IRELAND

For comparison with Icelanders (see "Iceland"), Pálsson recently studied some hundred Irish males. The serogenetic results (ABO, MNS, Rh, Hp, Gc, Gm, P, SEPh, AK, PGM: Pálsson et al. 1970; Walter and Pálsson 1973) and the data on anthropometry and pigmentation (Pálsson and Schwidetzky 1973d) have been published; the dermatoglyphic analyses are now ready for publication.

A serogenetic survey covering all counties and over twenty genetic systems was started by Tills in 1969 and continued by an IBP/HA expedition in 1970, which also incorporated PTC and skin color (Sunderland et al. 1973). Serogenetics did not reveal "any great differences which could be ascribed to Celtic ancestry." The proportion of consanguineous marriages as one aspect of the marital structure of the Irish popu-

lation displays some differences within the country (Masterson 1970, 1973). For earlier populations see Brothwell (1974).

ITALY

It seems as if the gigantic mass of data which Livi (1896) published in his *Military physical anthropology* at the end of the last century hindered for a long time the study of local populations. But recently this has changed, and many local projects are in progress. A sample from the male population of Latium had been studied by Correnti and his staff (measurements, pigmentation, descriptive characteristics: Correnti et al. 1970/1971; ABO, MNSs, Rh, Lutheran, Kell, Duffy, Kidd: Vecchi and Purpura 1970/1971). As a first contribution to the multidisciplinary project "Population Biology of the Alpine Communities," organized by the Institute of Anthropology in Turin, the marital distances of these communities have been studied (Lasker et al. 1972). In the context of research in the human paleoecology of the western Alps, the prehistoric and protohistoric investigations in the Monfenera area by F. Fedele (this volume) may be mentioned. Corrain and his staff have studied the *comuna* of Grignano-Polesine near Rovigo (serogenetics, PTC, anthropometry); autochthonous, nonautochthonous, and mixed subjects show significant differences, pointing at selective processes by the social systems of the *comuna* (Corrain et al. 1970a). Another project of this team are samples from Apulia and the Tremiti Islands (Corrain and Pesarin 1973). The population of the Colli Euganei (Padova) displays a differentiation related to historical regions as well as to economic and demographic differences (Corrain et al. 1969; Corrain and Pesarin 1969). Ethnic residual groups in Alpine valleys were the subject of further investigations: the Roman-speaking Ladines in some valleys of Trentino–Alto Adige (Corrain and Capitanio 1973; Corrain, Capitanio, and Bellinello 1970b, 1971a, 1971b; Corrain, Capitanio, and Gallo 1970; Corrain and Capitanio, this volume) and small isolated groups speaking an Old German dialect in the valley of Fersina (Corrain, Capitanio, and Bellinello 1973). The Istituto di Antropologia e Paleontologia Umana in Pisa (Parenti and staff) has started investigations on an isolated population of the eastern Linigiana (Sassalbo) and of the Ladine population of the valley of Fassa.

For thirty years the population of Sardinia has been the main research subject of Maxia and his staff (Maxia 1970; Maxia et al. 1970, 1972/1973; Schwidetzky 1973b); several local populations have been investigated in the last years, for instance in the mountainous regions of the Barbagia di Seulo (Fenu and Saiu 1970; Maxia and Fenu 1968) and of Nuoro (Maxia, Fenu, and Lucia 1971); in the southwest of the island (Maxia, Fenu, Floris et al. 1971); and in the northern valley of the Tirso

(Maxia and Fenu 1969). Metrical characteristics were compared for twenty communities (Maxia, Fenu, Floris et al. 1973).

There are many papers on single variables. Dermatoglyphics have been extensively studied in Sardinia (Maxia et al. 1972): no clines could be discovered; the distribution displays a mosaic of local subpopulations. Among the serogenetic studies, only a few consider several systems for several subpopulations; again Sardinia may be mentioned (ABO, MN, Ss, Rh, P, Kell, Cellano Duffy in different zones: Maxia et al. 1971; ABO, Lewis, Rh, MNS, Duffy, Kidd, P: de Bartolo et al. 1969). Many systems were studied for the populations of Bologna and Forli, but these were published singly in a wholes series of papers. A British team published gene frequencies (ABO, MNS, Rh, P, Kell, Duffy) from Lipari, one of the Aeolian Islands off Sicily (Warwick et al. 1972). Facchini and Martuzzi Veronese (1968, 1969) compiled and compared all Italian data on the Rh system.

There are so many new skeletal remains of prehistoric populations that it is impossible to mention every site and respective paper. A well-preserved Mesolithic individual has been studied by Borgognini-Tarli (1969). The earlier Neolithic period is represented by Maddalena di Muccia and Ripabianca di Monterado (Corrain and Capitanio 1968a). Rich material of the Eneolithic Gaudo culture was discovered in several sites in the province of Salerno (Corrain 1970; Corrain and Capitanio 1973). The Grotta de Farneto delivered new human remains (Facchini 1971), as did the site Buco della Scabla in Bergamo (Capitanio 1969; for other human remains see Corrain 1972; Corrain and Capitanio 1968a, 1968b; Corrain, Capitanio, and Espamer 1973; Messeri and Scarsini i.p.; Corrain and Capitanio 1968c, 1974; Maxia 1968; Parenti and Borgognini 1968). Corrain and Parenti (1973) give a survey on the Neolithic/Eneolithic finds in Italy arranged according to regions and cultures. ABO blood groups have been determined for the Eneolithic remains from Maggiano near Lucca and Agnano; in both small samples the authors found less O and more A than in recent populations (Paoli 1969). Of the Bronze Age sites, Franzine Nuovo (Verona) yields more skeletal remains yearly (Corrain and Capitanio 1970); and Castiglione/Ragusa, Sicily, must also be mentioned (Facchini 1973).

In the important Iron Age Villanova culture, incineration prevailed and skeletal remains are scarce (Benassi Graffi and Facchini 1972; Passarello 1973; Facchini, this volume). There are some new data on the nuraghic population of Sardinia (Germana 1970; Maxia et al. 1973), some new Pizeni (Capitanio 1973; Corrain and Capitanio 1969a), new representatives of the Ateste population (Corrain and Capitanio 1971), and newly published "Etruscans" (Facchini and Evangelisti 1973). The study of the population of Spina, a late and marginal outpost of the Etruscan dominion, has been continued (long bones: Marcozzi and

Cesare 1969). The Roman period is represented by the findings of Bagnacavallo near Ravenna (Facchini and Guerra 1969), from Volterra (Mallegni 1972), and from Cornus/Sardinia (Fenu and Pelosi 1968). A multivariate comparison of Etruscan, Roman, and Sabinian samples showed similarities between Etruscan and Roman and a more isolated position of the Sabinians (Cresta and Vecchi 1969; Vecchi 1969). Sicilian skeletal remains from different periods have been described by Passarello (1970) and by Passarello and Alciati (1969a, 1969b). The systematic collection of Langobard remains by Kiszely (see "Hungary") also resulted in papers on Italian findings (Kiszely 1970a, 1971, 1973; Kiszely and Maxia 1971; Kiszely and Scaglioni 1969); sporadic Mongoloid characteristics hint at population mixture, probably in the Hungarian settlements.

To date, only a few published remains from medieval times are available (Corrain and Capitanio 1969b; Martuzzi Veronesi 1968; Martuzzi Veronesi and Malacarte 1968; Passarello and Alciati 1969b). In some regions the materials permit diachronic comparisons (Corrain 1971; Facchini and Telesca Minelli 1972; Messeri 1969; Passerello 1970; Schwidetzky 1973b, using the data of Maxia and his staff); a synthesis of the racial history of Italy including ancient and recent populations is given by Passarello (1974).

THE NETHERLANDS

The period covered by this report begins with Constandse-Westermann's study (1968) on physical anthropology observations of the Dutch population. For five characteristics, regional variations were described and discussed: ABO blood groups, pigmentation, cephalic index, digital patterns, and stature. Two groups of subpopulations, a more northern and a more southern one, could be distinguished. The north–south subdivision later formed the basis for statistically more sophisticated comparisons (Constandse-Westermann 1972). On the population-genetics level, students studied consanguineous marriages and Dutch samples for tactile sensitivity, handclasping and armfolding, skin reflectance (Rigters-Aris 1973), and middigital and midphalangeal hair (the respective data are available at the Instituut voor Anthropobiologie in Utrecht). There is also a comprehensive serogenetic investigation (forty loci) of a Dutch sample by Fraser et al. (1974).

The link between recent and prehistoric/historic populations currently being studied is the cephalic/cranial index. There are some hints at decreasing regional differences and changes of clines, probably by migration and population mixture (Constandse-Westermann 1968), but much more material is needed for a satisfying ethnohistorical interpreta-

tion of recent regional differences. Van Vark (1972a) has described the Neolithic skull from Ryckholt, South Limburg, and Constandse-Westermann (1974) has studied Mesolithic material, not, however, of specifically Dutch origin. More recent material from the Meuse Valley, Rijswijk, Wijk bij Duurstede, and Deventer, among others, has come to the laboratories for restoration and elaboration. New techniques to obtain more data from the remains and also to make use of skeletal material of poor quality have been developed (van Vark 1972b, 1974).

NORWAY

A sample of Norwegian males has been studied by Pálsson (1974) for comparison with Icelanders (see "Iceland"). By an unusual method, namely questionnaires (about 19,000 subjects), the regional and social variations of height and weight were examined by Bjelke (1971). The Lapps are a favorite subject of serogenetic studies; sometimes they are compared with Norwegians (ADA: Camoens et al. 1972; Hp: Fleischer and Monn 1970; Lp, Ag, Gc, TF: Monn et al. 1971; PGM: Monn 1969).

Northern Norway as a marginal area in the racial history of Europe is discussed by Torgersen (1972). The different strata of the Scandinavian population can be well distinguished in the northwestern corner of the continent; skulls from Alta in western Finmark, studied by the author and compared with Lapp skulls as well as with Neolithic human remains from the Varanger-Fjord (Torgersen and Getz 1968; Torgersen 1968), are among the basic physical-anthropological materials for this discussion.

POLAND

The majority of Polish physical anthropological papers consider problems of growth, development, and applied anthropology, which were also the motive for the anthropometric survey of the Polish population carried out by the Anthropometric Commission of the Polish Academy of Sciences. The data for adults have now been published (Górny 1972), though not yet arranged into regional or ethnic groups but only into urban and rural populations. Certainly the basic data will serve for many detailed studies, as those for children and adolescents already have. The local-population studies organized by Dzierżykraj-Rogalski on the Hel peninsula have been continued by a typological analysis and comparison of autochthonous subjects and immigrants (Trzaska 1971). The parish of Ziemięcice in Gliwice district, studied by Gralla (1973), may be considered an isolate. The Walachian population, shepherds of the sub-Carpathian region, do not resemble the Romanians; it seems, therefore,

that the autochthonous population assimilated the immigrants, who transmitted pastoral culture and "Walachian Law" (Magnuszewicz 1970). The adaptation of immigrants to the new industrial environment of Nowa Huta has been studied using demographic and growth data (Panek and Piasecki 1971). The same author collected comprehensive data on the biology of the population of Bejsce (Piasecki 1973). The studies by Wolański on heterosis effects in the Polish population, though based on children, should also be mentioned here (Wolański 1974, this volume). Some serological research work completes the information from polyfactorial characteristics; the greatest number of systems is considered in the paper of Kostaszuk et al. (1973: ABO, MN, Sese, Rh, Kell, Hp, Gm, Inv (1), Gc, Ss, and P, for a Polish sample); a survey of earlier studies is given by Szwaykowski (1969).

The earliest skeletal remains studied in recent years are some small samples from the Danubian and Corded Ceramic cultures (preliminary data in Wierciński 1973). There are only a few new finds from the Bronze and Iron ages (Miszkiewicz 1971). Magnuszewicz is collecting and elaborating all physical-anthropological data on the ancient Slavs as a basis for solving the problem of their ethnogenesis. Warszaw–Wilanow yielded new findings of this period (Wiercińska 1969).

Of great interest is the material from Wiślica; six subgroups of the last millennium could be compared diachronically (Wierciński 1971); a very regular semiexponential trend of brachycephalization associated with other changes of the skull could be demonstrated. On a broader world-wide scale Wierciński (1974) interpreted this in terms of paedomorphic changes. Typological composition also changed in a regular way, and a homogenization of the population, probably due to growing panmixia, could be observed throughout Polish territory. The changes in long bones revealed at Wiślica and other Polish sites show a characteristic concavity in the seventeenth and eighteenth centuries probably due to a considerable lowering of living standards in this period (Wierciński 1971). Gralla has described mummification (1970).

PORTUGAL

No information about recent research work on living populations in Portugal is available except a Gc study. Da Cunha (1974) gives a survey of earlier studies. Among the prehistoric sites the Mesolithic Mugem is the most famous, but only some skull studies have been published to date. A complete elaboration of the skeletal remains is being prepared by Ferembach (1973). The burial caves near the west coast have yielded some new materials which may be Neolithic but cannot yet be dated more precisely (Gallay and Spindler 1970; Spindler 1972; Riquet 1972).

ROMANIA

An anthropological atlas of the Romanian people is the aim of intensive research work on local populations. The different regions of the country are being studied with some regularity by large multidisciplinary teams: Moldavia, Maramureş, Oas, and the delta of the Danube by physical anthropologists from Jassy led by O. Necrasov and M. Cristescu; and Wallachia, Banate, and Transylvania, particularly the passage of Bran, by the Anthropological Center of Bucharest led by O. Necrasov, S. Pop, and T. Enăchescu. In the region of the Iron Gates of the Danube the team led by S. Milcu and H. Dumitrescu continues its earlier research. Many villages have been studied comprehensively: anthropometry, descriptive characteristics, racial and biotypological problems, physiometry, biochemical and dermatoglyphic characteristics, etc., have been considered, and the anthropologists are often accompanied by medical men, demographers, etc. As examples of these comprehensive studies may be mentioned Fundata and Sirnea in the passage of Bran (Grinteşcu-Pop, Enăchescu, et al. 1968, 1970; Grinteşcu-Pop, Vlădescu, et al. 1970; Schmidt 1969, 1970); Cuhea, Icud and Dragomireşti, Giuleşti, Mara, and Sălişte a in Maramureş (Cristescu, Botezatu, et al. 1971, 1972; Necrasov, Cristescu, Botezatu, et al. 1971). In Oltenia, nine villages, distributed in the main natural zones between mountain and Danube Valley, have been similarly studied (Milcu and Dumitrescu 1968). Certain small ethnic groups are also being studied: the Bulgars of Muntenia, by Vlădescu (1973); the Germans of Transylvania by Grinteşcu-Pop, Enăchescu, and Radu (1973); and Czech, German, and Croat isolates in the Banata by H. Schmidt, who is preparing a physical-anthropological atlas of the Banata. Lipevanes and Tatars from the Dobrudscha differ from Romanians for ABO, MN, and Rh; this hints at their peoples of origin (Bîlbă 1969). A more detailed survey is given for the Rh (CD) distribution (Necrasov, Iakob, and Botezatu 1968).

With the new materials a synthesis of some traits was possible. Necrasov (1970/1971) describes an average Romanian type and the variability of the single morphological and serological traits.

The earlier populations represented by skeletal remains are always studied from many points of view: paleodemography and paleopathology, ecology, and rituals, as well as morphology. The large Boian-culture cemetery of Cernica from the Neolithic period yielded new materials now being studied by Necrasov and Cristescu; there are new skeletal remains from several sites of the Globular Amphorae culture and of the Horodişte a-Folteşti complex (Necrasov, Antoniu, and Fedorovici 1972; Necrasov and Onofrei 1972), and an important sample of the Bronze Age Noua culture (Necrasov and Cristecu 1968). A survey of the Neolithic and Bronze Age populations is given by Necrasov and Cristescu (1973).

Their conclusion is that the Mediterranoid basis of the recent population goes back to the Neolithic period.

As in other countries, Iron Age finds are less frequent, but they could be increased (Nicolaescu-Plopşor 1968; Bolomey 1968). The same is true for the Roman period (Botezatu and Fedorovici 1973) and the migration period (Georgescu 1972; Necrasov, Cristescu et al. 1969; Nicolaescu-Plopşor 1969a, 1969b; Nicolaescu-Plopşor and Wolski 1971, 1972; Rişcutia et al. 1969). The large sample from Brătei is now being prepared for publication by Necrasov and Ştefănescu. Two Gepid skeletons should also be mentioned (Wolski and Nicolaescu-Plopşor 1972).

In early medieval times the formation of the Romanian people was in progress. The earliest remains from this period are those of the seventh through ninth centuries from Sultana and Izvorul. The more recent centuries are represented by several cemeteries studied by different authors (Botezatu and Ştefănescu 1969, 1970a, 1970b; Nicolaescu-Plopşor and Popovici 1971; Popovici 1968, 1969a, 1969b, 1970, 1971, 1972a, 1972b, 1973a). Some later cemeteries were also studied, and microevolutionary trends could be seen by comparison of successive generations in the same place (Popovici 1969b, 1973b; Botezatu and Ştefănescu 1970a, 1970b). The skeletal materials permitted a new synthesis of the physical-population history of the country. Necrasov (1973) gives a survey and a bibliography of the main finds from Paleolithic times; the most distinct trend is the "dinarization" of the population, which can be seen particularly in the changes of the neurocranium; immigration and population mixture seem not to be a sufficient explanation. The trend continues; villages studied some decades ago and again recently reveal ongoing dinarization (Necrasov and Cristescu 1969; Necrasov, Cristescu, Botezatu et al. 1969; Cristescu et al. 1969).

SPAIN

Recent and current research work on living populations has concentrated on two groups of variables: (1) monofactorial serological traits; (2) polyfactorial characteristics of high heritability, especially dermatoglyphics. In recent years the systematic study of both kinds of variables has been continued by Pons and his staff, particularly in Asturias and Gran Canaria (Asturias: Planas et al. 1968; Egocheaga 1973; Gran Canaria: Pons et al. 1968; Planas et al. 1969; see Pons 1970). For four Spanish samples (Andalusian, central Mesetan, Galician, and Basque) Goedde, Benkmann et al. (1972) and Goedde, Hirth et al. (1972) determined phenotypes and gene frequencies of six enzyme polymorphisms.

Schwidetzky (1971b, 1973b, 1975) has published the main results of a physical-anthropological survey of the Canary Islands (metrical and descriptive characteristics and pigmentation) and compared the structure of the living with that of the pre-Spanish population: in both periods there are the same differences between mountain and coast, and opposite differences between south and north in Tenerife, due to the stronger Spanish immigration to the north. A regional population type on Gran Canaria has been identified with a prae-Spanish tumulus population, and the effect of socioeconomic retardation in isolated settlements has been studied. The complete report (in Spanish) is in press.

Among the earlier populations, the Neolithic and Chalcolithic draw special interest: Garralda (1975) has restudied them critically; Alcobé et al. (1978) have prepared a survey on the known finds, including several Catalonian samples published by Riquet (1970). New remains from different periods have been described for Mallorca (Garralda 1971, 1972, 1973); and our knowledge of the Visigoth population of the peninsula is increasing (Varela Lopez 1974/1975).

SWEDEN

Some information on living populations is available: the marital structure of a North Swedish population has been analyzed by Beckmann and Cedergren (1971), revealing an increase in long-distance matrimonial migration between 1930 and 1960 but unaltered frequencies of endogamous matings. Lewin et al. (1973) have published body measurements of Swedish males fifty to seventy years old. Swedes living in Finland are considered by Mark (1970) for comparison with Finns and other Finno-Ugrian peoples. Among the serogenetic traits, the most complete regional survey is given for Hp (Höglund et al. 1970). It is compared with the regions which were earlier distinguished by Beckman for other serogenetic characteristics. Beckman's southwest region with West European relationships can be distinguished, as can low frequencies in the north, which point at Lapp influences. The highest frequencies were found in some eastern areas.

A center of bone reconstruction and elaboration is the Osteological Research Laboratory of the University of Stockholm in Solna (Gejvall and Sjövold), where the new journal, *Ossa*, is now edited. The well-preserved Mesolithic skeleton from Bäckaskog, formerly considered a fisherman, has been identified as a "mother of several children" (Gejvall 1970); the Neolithic remains have been compiled, newly calculated, and discussed by Jörgensen (1973).

SWITZERLAND

The most comprehensive research project now in progress is the interdisciplinary study in Le Clos du Doubs (Jura de Bern): physical and cultural geography, demography, economics, medical research, etc., are involved. The physical-anthropological team has considered anthropometry as well as serology, taking in nearly 70 percent of the population of eight villages (Moeschler 1972). Final results have not yet been published. A local population in the valley of the Inn (Unterengadin) has been studied by Schlegel (1974). Dermatoglyphics — not well-known for the country — from a German-speaking Swiss sample were studied by Scheffrahn (1972). Serological investigations in the isolates of Graubünden are in progress for a Zürich dissertation. Foreign human geneticists have been interested in the marital structure of the population (Hussels 1969; Morton and Hussels 1970; Morton et al. 1973; see also Collogue Recherches anthropologiques "sur la biologie de la population suisse." *Arch. Suisse d'Anthrop. gén.* 40(1).)

A survey on the Neolithic populations of Switzerland is given by Scheffrahn (1969) and one on the human remains from the Neolithic and the early Bronze Age by Sauter (1973). The Cortaillod culture, with the well-known samples from Chamblandes and Collombey (Barmaz I and II) is the best represented; the finds have been the subject of several special studies (Brabant 1971; Moeschler 1971). A new Neolithic site has also yielded human remains (Scheffrahn 1974). A survey on the physical anthropology of early medieval times has been published in Zürich (Brunner 1972).

U.S.S.R.

Comprehensive physical-anthropological surveys of nearly all ethnic groups and geographic regions were published before the period covered by this report, including that on the Russians (Bunak and Alekseeva 1965), which also compiled the data from earlier studies in maps. Of the 280 samples there arrayed, 186 have been used for a multivariate analysis with fourteen variables (measurements, pigmentation, descriptive characteristics); it confirmed in general the population types distinguished by the Soviet authors and the strong relationships between ethnic and physical-anthropological differentiation in the European part of the Soviet Union (Schwidetzky 1971a).

Serological characteristics were not considered in these publications, but recently new maps for ABO distribution have been published (Bunak 1969; Danilova 1971). Two main zones can be distinguished: the northeast has more q and less p than the southwest. For other serological polymorphisms, a detailed geographic survey is not yet possible, though

many studies are in progress (for instance Starovoĭtova 1973; Nersesjan et al. 1971). The same is true for dermatoglyphics. New samples are available for Estland, Lettland, and Litauen, northern Russia and Byelorussia, Karelians and Vepsi (Chit' 1969; Denisova 1970; Chorn et al. 1972; Prokudina 1971).

Of publications on recent local groups, the most comprehensive and important are those of Mark on the Finno-Ugrian peoples and Gadžiev on Daghestan. Mark (1970) studied fourteen measurements and thirty-two descriptive characteristics of ninety-one Finno-Ugrian and twenty-one other ethnic samples (Swedes, Tatars, etc.); she discusses the physical-anthropological results in connection with linguistic and prehistoric facts and hypotheses as regards the human remains from the Mesolithic onward. One of her major discoveries is that in the ethnogenesis of the Finno-Ugrian peoples an early Mongoloid infiltration is well proved, but the later ethnohistory was very different, as is reflected by the different population types, which the author distinguishes, summarizing many details.

Gadžiev (1971) studied twenty-eight small populations in Daghestan and other Caucasian regions, arranged in five ethnic-linguistic groups in a comprehensive way: demographic data, many measurements and descriptive characteristics, dermatoglyphics, and three blood-group systems were considered and treated statistically in many ways (though multivariate analysis has not yet been applied). Some results are: the interlocal variability is greater than the interethnic one; isolation and mixture are better expressed by dermatoglyphics and blood groups than by metrical and descriptive characteristics.

The Lapps of Kola have also been the subject of a special study (Chazanova 1971; Chazanova and Samljan 1970).

Much work is being done in the U.S.S.R. on the study of skeletal remains of prehistoric populations. Only the most important papers can be mentioned. The southern forest–steppe zone of the Ukraine has yielded the richest finds, beginning with the Mesolithic fisher–hunter populations of the Dnieper region, up to medieval Slavic populations. Konduktorova (1971a, 1973) has studied many of these finds and published a new survey of the paleoanthropology of the Ukraine (see also Zinević 1972; Zinević and Kruc 1968; Ziljaeva-Kruc 1972; Kruc 1969; Konduktorova 1969). A special study treats new and earlier Sarmatian remains of the lower Volga (Firštejn 1970); the last period differs from the earlier, which may hint at a new immigration. Similarities with the Bronze Age population of the same regions point toward the ethnic assimilation of the autochthonous population (for Scythian populations, see Konduktorova 1971b). Gadžiev (1972) and Abdušeližvili (1973) discuss the ethnic history of their Caucasian areas using physical-anthropological data. Denisova (1973a, this volume) has studied the skeletal remains from the important site Zveinieki, in Latvia.

The Slavic population of medieval times is well represented by skeletal material. Alekseeva (1972, 1974), who had published earlier on the main materials, compared them diachronically and with German tribes of the same period. Recently she gave a comprehensive summary and analysis of all materials concerning the ethnogenesis of eastern Slavs (Alekseeva 1973): the data on all tribes for which skeletal material has been studied are collected, mapped, and compared *inter se* and with other ethnic groups of this period, such as Germans and Finns; in the same way the data from recent populations are arranged and analyzed. There is certainly an assimilation of pre-Slavic populations, as evidenced by skeletal and recent materials, but the differences between the Old eastern Slavs are remarkably small and point at an expansion of a rather homogeneous ethnic group. The ancient Balts as well as the recent ones are analyzed and compared by Denisova (1973b). Their physical-anthropological characteristics can be traced back far into prehistory. Rich skeletal materials have come from medieval cemeteries of the Crimea (Zinević 1973).

The difficulty of comparing skeletal and living populations led the Soviet School of Craniology to form a systematic collection of recent craniological material: Alekseev (1969) studied fifty modern skull samples, including the measurements of facial flatness by which Mongoloid infiltration may be appraised. Many diachronic comparisons form the basis for the discussion of ethnogenetical problems, such as that of the origin of the Baltic and the Finno-Ugrian peoples in the northern part of the Soviet Union.

Last, two syntheses must be mentioned: Debetz (1973) gave a survey on Neolithic and early Bronze Age finds in the U.S.S.R., and Bunak (1976) on the racial history and ethnogenetic problems of the European part of the Soviet Union, including prehistoric/historic and recent populations.

YUGOSLAVIA

As in other socialist countries, problems of growth, of the relationship between physical characteristics and health, and of applied physical anthropology play an important role. There has not been much research work on local living populations in recent years. The best recent survey we have for the ABO blood groups is based on 70,000 blood donors and arranged according to regions and ethnic groups (Radović et al. 1971/1972). Further serogenetic traits studied in recent years for more than one sample are Hp, Gc, Gm, Inv, and E_1 (Fraser et al. 1969; Ropartz et al. 1972). Gavrilović (1968, 1969) refers to his earlier studies of most of the various ethnic groups of the country. The most comprehen-

sive study of a local population is that of an ethnic minority, the Gypsies of the Prekmurje region in Slovenia (Pogačnik 1968); it consists mainly of the descendants of five families and is rather homogeneous with regard to measurements, pigmentation, and descriptive characteristics, but its social and reproductive isolation are beginning to break up. Samples of the main ethnic groups of the country — Kroatians, Slovenians, Bosniaks, and Montenegrins — have been studied by Djačenko (1972) for comparison with respective groups in the Ukraine; Boev (1972b) mentions his own fieldwork in Montenegro, and the Polish anthropologist Miszkiewicz (1974) classified Schade's Macedonian material according to the Polish typology.

Among the skeletal remains of earlier populations, those from Lepenski Vir must be mentioned first; this is a settlement near the Iron Gate with C_{14} data from 5410 to approximately 4300 B.C. and unique forms of pre-Neolithic houses and other cultural inventory. Meanwhile new sites from this period have been discovered and more studies on skeletal remains are being prepared for publication. The skulls of four pre-Neolithic individuals from Lepenski Vir are very large and robust, their stature tall (Nemeskéri 1969; for a detailed study of femur and pelvis, see Negovanović 1970, 1973). Lengyel (1970) made laboratory examinations of bone samples from the pre-Neolithic to the Bronze Age, proved sex and determined age by chemical methods, and determined the ABO blood groups by his modified fluorescent-antibody method. To the Starčevo culture, early Neolithic period, belong ten skulls from Vinča near Belgrade (Schwidetzky 1971/1972); they fit well with other Neolithic populations of the Balkan peninsula, where gracilization and brachycranization begin early. Mokrin, North Banata, is an important early Bronze Age site (Farkas and Lipták 1971). The Hallstatt period, represented here by Illyrian tribes, yielded remains from Slovenia (Angel 1968) and Bosnia (Schwidetzky 1969). The remains from the graveyard in Kranj could be Langobard (Kiszely 1970b). Remains of earlier and later medieval already-Slavic populations are coming to light in Bled (ninth through eleventh centuries), where excavations have been in progress for many years (Tomazo et al. 1971/1972), and also in Prilep, Macedonia (Miszkiewicz 1974).

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SECTION ONE

Recent Populations: Structure and Differentiation

Microevolution and Exogamy

GINETTE BILLY

It surely occurs to no one nowadays to challenge the existence of diachronic or "microevolutionary" transformations affecting present-day mankind. And yet it was not long ago that the typology which resulted from the great surveys of the last century still served as a guide for all population studies. For example, Deniker's "Alpine type," which is defined according to his tripartite typology as short, dark, and brachycephalic, arguably survived until 1960 (Billy 1960), when it was proven that the contemporary Savoyard is generally tall and fair.

The first diachronic transformations to be observed were, as a matter of fact, those affecting stature, and they are still the best known, although the origin of the increase in height, which has been remarked upon virtually everywhere for nearly a century, is still unclear. Also, in the past twenty years, a phenomenon of contemporaneous debrachycephalization occurring in certain areas of western Europe (Switzerland, Savoy, Brittany, Poitou, the north of France) has become apparent, thanks to the existence of old documents which cover a period of time. But stature and cephalic dimensions are the only characteristics which can be analyzed by means of such documents, when they exist; the efforts made with regard to pigmentation are necessarily doomed to failure due to the lack of a color scale. Using this method of comparing means, it was difficult to investigate the behavior of certain other characteristics: indeed, it was even impossible to envision the fundamental study of interrelationships among the changes in the different parameters.

It was with this in mind that I was led to propose a new method (Billy 1966) which would make it possible henceforth to analyze microevolutionary phenomena in a population, not at the collective but at the individual level, among subjects who are blood relatives. After briefly reviewing the method, I will examine its possibilities by presenting the

major findings obtained in the case of a population in the southwest of France (Poitou) for the three basic characteristics of stature, cephalic dimensions, and eye pigmentation. Finally, among the hypotheses put forward to explain current microevolutionary phenomena, I will provide some concrete arguments in favor of exogamy in its broadest sense, that of a decompartmentalization of populations. These make up an appreciable number of findings added to the account of microevolution during the past several years.

THE FAMILY LINE METHOD

The method is based on comparing two successive generations from a homogeneous population sample which is geographically quite localized. In 1965 I made such a study of a population sample, a group which had been settled in Poitou for at least two generations and which was made up of 300 subjects of both sexes, eighteen to eighty-three years of age and divided into 113 families. Of these, fifty-seven were complete, including the father, the mother, and one or more offspring, and fifty-six were incomplete, having only one parent. In this way, I was able to compare the different characteristics of the generations of parents and offspring, and then the changes which had come about between the two generations in each group of offspring: fathers/sons, mothers/daughters, fathers/daughters, and mothers/sons.

This method makes it possible, on the one hand, to eliminate any factor of racial heterogeneity, a factor which is too often neglected in comparisons of populations, and, on the other hand, to extend the study of the phenomena to the female sex, i.e. to make a precise statement of the influence of sex, which is still poorly understood. Such a cross-sectional method, which may be carried out by a single investigator, can be generalized to any evolutionary characteristic whatsoever, in any population. Moreover, it permits analysis of the relationships between the various parameters in their diachronic evolution and, finally, it leads to the first studies ever made of genetic influence on microevolutionary phenomena.

EVOLUTION OF HEIGHT

Height increased significantly in Poitou from one generation to the next, both in men and in women. The comparisons were applied to "adjusted heights" by means of a corrective factor which is a function of the individual's age (Büchi 1950), in order to allow for the influence of senescence.

It is statistically proven that the rate of this phenomenon, which has

existed for some time, is presently accelerating among the younger generations. As a matter of fact, the existence of significant negative correlations between height increase and subject age in each group of the same sex implies that the younger the individuals themselves are, the more marked is their growth with respect to the parent generation (Billy 1968). The process of height increase is thus going on at a higher rate today than previously. This recent acceleration of the phenomenon is likewise made evident by the study of height variations as a function of subject age in the parent and offspring groups, as shown in Figure 1.

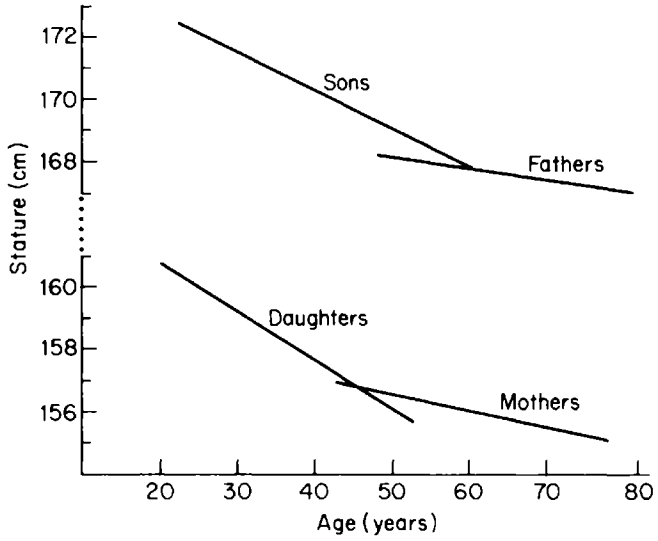

Figure 1. Evolution of height as a function of subject age

It may be seen that whereas the connection is rather weak in the parent group, it is much closer in the second generation, which implies a more marked evolutionary character; this surely is proof that the phenomenon, already begun in the parent generation, has a preferential effect on younger subjects. Figure 1 also makes it possible to locate approximately the beginning of the acceleration phase, which takes place in women of about forty-five and in men of fifty-five.

The two phases which are thus pointed up differ likewise in terms of their mechanisms. The old phase, which lasted through the past century, is characterized by a lessening of dispersion which in fact corresponds to an increase in height through a reduction of the total number of subjects of small stature. Indeed, the existence of highly significant correlations:

	Men	Women
Δ height/parent height	−0.524	−0.621
t (Student test)	4.80	7.70

proves that the shorter the parent himself is, the more pronounced, on the

average, is the height increase from one generation to the next. The mechanism is surely working here toward a greater homogeneity.

The recent phase, on the other hand, is characterized by a tendency toward dispersion. If, in fact, one considers the variations in height increase between generations and the variations in height of offspring, the correlations which are obtained:

	Men	Women
Δ height/offspring height	+0.704	+0.347
t	9.26	2.99

show that it is precisely the tallest descendants who have undergone the greatest increase in height. The process goes so far as to reverse itself, moving toward a reduction in height for the shortest descendants, since it is precisely among the descendants of the shortest parents that most of the cases of height reduction are encountered; it is, on the contrary, among the descendants of the tallest parents that the most marked instances of height increase are to be found.

Thus contemporary evolution in height is characterized by two opposing tendencies: a tendency toward greater homogeneity through preferential reduction of the number of short-statured subjects, and a tendency toward greater heterogeneity through accentuation of the extremes.

CHANGES IN CEPHALIC DIMENSIONS

Paralleling the height increase, the cephalic index decreased from one generation to the next in both sexes, the change having been brought about by a reduction in width of the head combined with an increase in length (Billy 1966). The phenomenon of debrachycephalization can be seen in the interaction of covariants between the cephalic index (or its components) and the age of the subjects in each group.

Thus Table 1 shows the existence of positive correlations in each group; the oldest subjects are thus the most brachycephalic. But whereas the dependences remain weak in the case of the fathers and mothers, they

Table 1. Correlations of the cephalic index and its components as a function of subject ages

		Cephalic index		Width		Length	
	n	r	t	r	t	r	t
Fathers	76	0.042	0.37	0.011	—	−0.015	—
Mothers	92	0.149	1.45	0.102	0.95	−0.049	—
Sons	87	0.351	3.72	0.388	4.24	−0.262	2.60
Daughters	108	0.260	2.98	0.236	2.60	−0.070	0.73

become very significant in the offspring generation. It may be concluded from this that the phenomenon of debrachycephalization has gone on at different rates since the beginning of the century.

The first phase corresponds to a transformation which had barely begun for the parents, born in 1905 on the average; the second, on the other hand, shows a very pronounced debrachycephalization for the offspring generation. The acceleration phase begins with the years 1920–1925, as is shown by the negative slopes in Figure 2, i.e. shortly after the First World War, since this phase affects subjects under forty years of age.

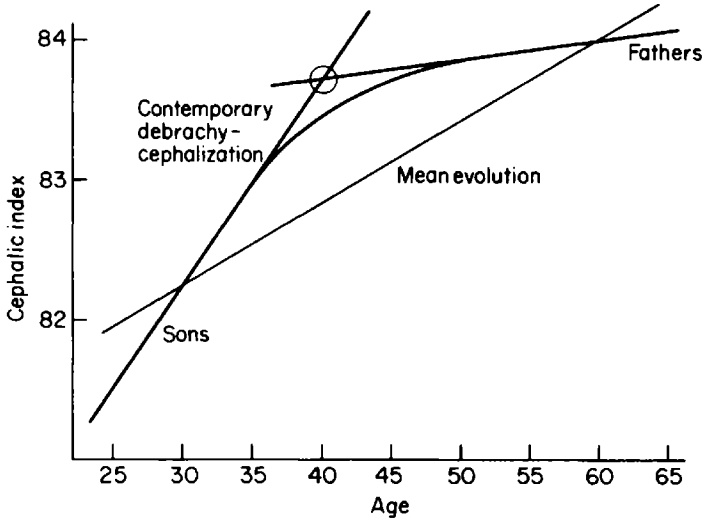

Figure 2. Debrachycephalization in men

It can be seen that the rates of height increase and debrachycephalization are simultaneous, which suggests that there are connections between these two processes. Finally, the phenomena which are shown to exist in a racially homogeneous group, within a single family, necessarily occur in a particular locale and are not the result of drastic mixture of population.

EVOLUTION OF EYE COLOR

If we merely compare the frequencies in the different pigmentation classes, we note a tendency toward a deeper color of the iris in the younger generations, even though the differences are never statistically significant. But before concluding that there is a diachronic process of nigrescence, we must make allowances for the well-known phenomenon of lightening of eye color during senescence and also take into consideration the connections between the degree of pigmentation and the age of the subjects, keeping sexes and generations separate. Somatic involution,

which works toward a lighter eye color after the age of fifty, ought to result in positive correlations were there no evolution at all. As a matter of fact, there is no instance in which the connections are significant. This is why I was led to form the hypothesis of two concurrent phenomena: one of these would represent a long-term process of depigmentation, with a preferential effect on younger subjects; the second would represent a process of senescent depigmentation; and the effects of the two would tend to cancel each other out.

A hypothesis of this sort was confirmed by the results of individual analysis, in studying, in each family, the differences in pigmentation among direct descendants with the age of the parents taken into account. In this way, it becomes apparent that there is a significant connection between the cases of depigmentation and the offspring of the youngest parents. On the other hand, the cases in which eye pigmentation is stable or grows darker occur most commonly among the offspring of the oldest subjects, i.e. only among those who are past the age of fifty: what we have here is certainly a result of senescent depigmentation. Such observations, established statistically by application of the χ^2 metric (8.33 for one standard deviation), prove that there is a diachronic process of depigmentation which is presently affecting the younger generations, coupled with a process of senescent depigmentation. The existence of this contemporary depigmentation process is, moreover, confirmed for the "complete" families by consideration of the cases of lightening or nigrescence as they relate to the mean age of both parents, as shown in Table 2.

Table 2. Fluctuations in pigmentation as a function of average age of parents in "complete" families

Age / ΔP	<53		53–61		>61			Age / ΔP	<53		>53		
+	9	3.4 / 5.6	6	−0.3 / 6.3	4	−3.1 / 7.1	19	+	9	+3.4 / 5.6	10	−3.4 / 13.4	19
=	8	−4.6 / 12.6	16	1.6 / 15.4	19	3 / 16	43	= or −	13	−3.4 / 16.4	43	3.4 / 39.6	56
−	5	1.2 / 3.8	3	−1.3 / 4.3	5	0.1 / 4.9	13		22		53		75
	22		25		28		75						

If one considers only positive deviations from the theoretical frequency (the figures that are underlined in the contingency tables), it can be seen that the cases of depigmentation are most often associated with the younger parents, whereas the older parents are associated with the

cases in which there is no evolution. The value for χ^2 (3.91), obtained by reordering the cases so that the theoretical frequency is higher than 5, shows that such a dependence exceeds the significance threshold of 5 percent ($\chi^2 > 3.84$). This is surely proof that there is a diachronic process of denigrescence which affects especially the younger generations, in the same way as the current phenomena of height increase and debrachycephalization.

RELATIONSHIPS AMONG THE PHENOMENA OF HEIGHT INCREASE, DEBRACHYCEPHALIZATION, AND DEPIGMENTATION

The facts that the three microevolutionary phenomena are simultaneous and that their acceleration phases coincide for both sexes suggest that they are related in ways which argue for a common origin.

Considering the set of correlations among stature and cephalic index or variations of the two between successive generations, as shown in Table 3, I have demonstrated (Billy 1970a) that height increase and debrachycephalization are, in their current phase, directly related to each other through the fluctuation in head length. But while there is a direct significant relationship between the two phenomena in men (Δ stature/Δ cephalic index = 0.295), conditions are different for women, since, in their case, head length and the changes it undergoes are always significantly linked with stature or its variations (the underlined figures in Table 3 represent correlations which are significant at a threshold of 5 percent).

Table 3. Correlations between variations in stature and cephalic data

	♂♂	♀♀
1. Δ stature/Δ cephalic index	<u>−0.295</u>	−0.018
2. Δ stature/Δ head length	<u>+0.287</u>	+0.096
3. Δ stature/Δ cephalic index (offspring)	<u>−0.406</u>	−0.504
4. Δ stature/Δ head length (offspring)	<u>+0.358</u>	+0.010
5. Δ cephalic index/height of offspring	−0.029	<u>−0.317</u>
6. Δ head length/height of offspring	−0.117	<u>+0.424</u>
7. Δ cephalic index/height of parents	+0.254	<u>−0.305</u>
8. Δ head length/height of parents	−0.244	<u>+0.252</u>
9. Cephalic index (offspring)/height of parents	+0.190	<u>−0.305</u>
10. Head length (offspring)/height of parents	−0.216	<u>+0.369</u>

It will be noted that the most pronounced cases of debrachycephalization are associated with the tallest mothers (correlation 7) or daughters (correlation 5) and that this comes about through the variations in head length (correlations 8 and 6).

Since debrachycephalization has a preferential effect on subjects who

are both taller and younger, must we therefore conclude that the contemporary depigmentation of the iris is likewise associated with these subjects? As a matter of fact, statistical analysis confirms the existence of a very significant preferential relationship between the cases of height increase and those of depigmentation of the iris ($\chi^2 = 5.43$ for one standard deviation). Now, if one takes into consideration variations in pigmentation and in the cephalic index from one generation to the next, homologous results are obtained; the instances of debrachycephalization in fact stand in a preferential relationship with the cases of depigmentation, while the cases of debrachycephalization are linked with those of nigrescence. As in the case of increase in head length, the dependence is truly significant only for the female sex, where the value of χ^2 equals 6.37 (two standard deviations).

It is, in the final analysis, apparent that the diachronic processes of debrachycephalization and of height increase are both connected with the phenomenon of depigmentation of the iris. Though they are of variable degrees of closeness, the dependences obtained for both sexes are in agreement: whereas the relationship between depigmentation and height increase is very close in men, it is the women who show the closest relationship between the phenomena of depigmentation and of debrachycephalization. In any case, it may be concluded that there is a contemporary evolution toward a closer approximation of the tall, dolichocephalic, light-eyed phenotype.

THE INFLUENCE OF EXOGAMY

Among the hypotheses put forward to explain these microevolutionary phenomena, one of the most decisive is certainly that of the progressive breaking up of isolates (Billy 1962: 176, 199), a process which became more pronounced in Europe at the time of the First World War. At any rate, this hypothesis explains the common acceleration phases for the different processes beginning with the years 1920–1925 (Billy 1968). It is also supported by the parallelism between the distributions of endogamy and those of the brachycephalic type in France (Billy 1962: 198), as well as by the existence of a negative correlation between height averages and consanguinity coefficients for all French departments (Schreider 1968). In this way, then, the greater mobility of contemporary populations would result in a mixing of genes and in a higher frequency of heterozygotes.

According to Schreider (1968), everything in fact leads one to believe that "the heterosis effect, which is manifested in space through height differences in correlation with consanguinity coefficients, must also be manifested in time through diachronic growth in height."

If such is the case, exogamy, in its broadest sense, must bring about within a given population the same kinds of changes in head shape and in height as those which have been recorded for about a century.

This is the point I sought to clarify on the basis of homogeneous population samples from Poitou and Savoy. Savoy, indeed, since it has been a focal point for debrachycephalization and height increase since 1880 (Billy 1962), seemed to me to be especially well suited for this study by virtue of its geographical isolation and the resultant endogamy.

In this way, I showed that subjects born of marriages between individuals from different places of origin have both longer and narrower heads than those whose parents come from the same community, and that they are also taller. Moreover, the results bring out the existence of a significant relationship among these different parameters in terms of the increasing importance of the parents' birthplaces. It must thus be granted that increase in height ($\chi^2 = 10.7$ with four standard deviations) and debrachycephalization ($\chi^2 = 13.05$ for men and 0.75 for women), along with the increased importance of parental birthplaces, are indeed the results of exogamy, that is, of a greater mobility on the part of the parent generation, which works toward a greater degree of heterogamy among their offspring.

Furthermore, the correlations between individuals which are given in Table 4 show that the distance between the parents' places of origin influences offspring in the same general way as the increasing importance of the center of population does.

Table 4. Correlations between cephalic or height parameters and the distance between parents' birthplaces

	Men			Women		
	n	*r*	*t*	*n*	*r*	*t*
Head length	233	+0.08	1.23	143	+0.131	1.6
Head width	233	−0.214	3.43	143	−0.084	1.0
Cephalic index	233	−0.217	3.47	143	−0.164	2.0
Stature	226	+0.03	0.4	141	+0.218	2.71

Greater distance results in a process of debrachycephalization, which is particularly marked in men, and which is combined with a very noticeable increase in stature in women. It is the direction of the diachronic manifestations which is to be attributed, in this case as well, to the influence of growing exogamy among present-day populations. Such results are of great interest, because they offer proof of the influence of exogamy on contemporary phenomena of microevolution.

SUMMARY AND CONCLUSIONS

Thus, with the aid of an original method, I have determined the mechanism of certain microevolutionary phenomena, specified their intensity, and made an estimate of their origin in time. In addition, I have pointed out, for the first time, the existence of direct relationships between the various evolutionary processes currently affecting stature, shape of the head, and pigmentation. Analyzing the problem on the level of the individual, I have thus shown that precisely the same subjects grow taller, undergo debrachycephalization, and show depigmentation of the iris in comparison with their parents. At the same time, a certain amount of light has been cast on the mechanism of genetic transmission between the two successive generations.

I have finally shown that exogamy, in its broadest sense, brings about within a given population changes in stature and in head shape which are absolutely identical with the diachronic variations recorded in our time. It must thus be concluded that one of the essential causes of microevolutionary phenomena is provided by a greater mobility on the part of modern populations, a mobility which results in the mixing of genes and in a growing frequency of heterozygotes.

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Constitutional Research on Italian Army Recruits

LUIGI BRIAN and ANTONIO GUERCI

The authors (who contributed equally to the structuring of the work; in addition, Guerci prepared the statistical data) have long been carrying out systematic research on human peoples, in relation either to constitutionalism or to characterology. The importance of these studies has been defined by Martiny (1948): "Biotypology, as a 'new science,' on the strict basis of an experimental observation and of statistics, deals with the correlations between the human form, its physiology and its psychism, and tries to study Man in his unitary whole."

It must be stressed that apart from a few rare cases, no general work has ever dealt with this argument in the course of this century and since the extensive survey conducted by Livi (1896) covering about 300,000 recruits of the 1859-to-1863 contingents.

Our work is a study of a first group of 7,056 recruits of the 1948-to-1950 contingents, representing the twenty Italian regions. Only fourteen regions are shown in Table 1, for a total of 6,898 recruits. As will be noted, there is a minimum of subjects (137) for the Marches and a maximum (1,057) for Lombardy.

The dimensions considered, for the successive constitutional diagnoses, are as follows: stature (from the vertex; symbol St tt); seated height (from the vertex; symbol St sd); diameter of the thorax (biacromia: Dt Tc); diameter of the pelvis (biiliocristal: Dt Bc); thoracic perimeter (xifoidian: Pm Tc); and abdominal perimeter (mesogastric minimum: Pm Dd). Figures 1 and 2 show the differential intensities of the average normalities of the stature and the thoracic perimeter; these are the most indicative. Table 2 shows the general graph (symbol GG) of the

This work was carried out by one of our Institute's teams, thanks to the help and cooperation of the Italian military authorities.

Table 1. Regional sample frequencies

Region	*f*
Abruzzi	140
Basilicata	186
Calabria	343
Campania	791
Emilia	403
Latium	568
Lombardy	1,057
Marches	137
Piedmont	293
Puglia	794
Sardinia	316
Sicily	933
Tuscany	307
Venetia	630
Total	6,898

Figure 1. Stature averages in the different regions

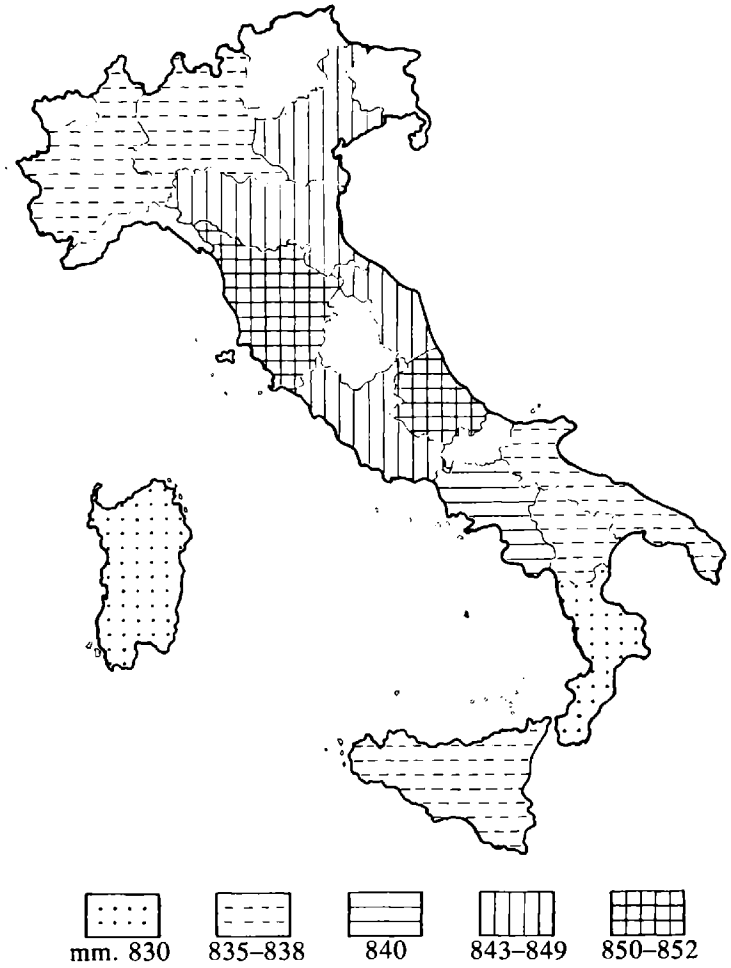


Figure 2. Thoracic perimeter averages in the different regions

Table 2. General graph of the total sample (7,056 subjects). Average St tt = 1677.9 (1678); sigma = 66.891; 3 sigma = 200.673. Fundamental (St tt) ratio: 1879: 1678 = 1.1197

	St tt	St sd	Dt Tc	Dt Bc	Pm Tc	Pm Dd
+16	.....	.....	544	396	1,161	1,050
	.....	.....	540	392	1,151	1,041
+15	.....	.....	535	389	1,141	1,032
	.....	.....	530	386	1,131	1,023
+14	.....	.....	526	382	1,121	1,014
	.....	.....	521	379	1,111	1,005
+13	.....	.....	516	375	1,101	996
	.....	.....	511.5	372	1,091	986.5
+12	.....	.....	507	369	1,081	977
	.....	.....	502	365	1,071	968
+11	.....	.....	497	362	1,061	959
	.....	.....	493	350	1,051	950
+10	.....	.....	488	355	1,041	941
	.....	.....	483	352	1,031	932
+9	.....	.....	479	348	1,021	923
	.....	.....	474	345	1,011	914
+8	2,000	1,056	469	341	1,001	905
	1,979.5	1,045	464.5	338	991	895.5

Table 2 (*continued*).

	St tt	St sd	Dt Tc	Dt Bc	Pm Tc	Pm Dd
+7	1,959	1,034	460	335	981	886
	1,939	1,024	455	331	971	877
+6	1,919	1,013	450	328	961	868
	1,899	1,003	446	324	951	859
R Ma	1,879	992	441	321	941	850
	1,859	981	436	318	931	841
+4	1,839	971	432	314	921	832
	1,819	960	427	311	911	823
+3	1,799	950	422	307	901	814
	1,778.5	939	417.5	304	891	804.5
+2	1,758	928	413	301	881	795
	1,738	918	408	297	871	786
+1	1,718	907	403	294	861	777
	1,698	897	399	290	851	768
BB	1,678	886	394	287	841	759
	1,658	875	389	284	831	750
−1	1,638	865	385	280	821	741
	1,618	854	380	277	811	732
−2	1,598	844	375	273	801	723
	1,577.5	833	370.5	270	791	713.5
−3	1,557	822	366	267	781	704
	1,537	812	361	263	771	695
−4	1,517	801	356	260	761	686
	1,497	791	352	256	751	677
R Mi	1,477	780	347	253	741	668
	1,457	769	342	250	731	659
−6	1,437	759	338	246	721	650
	1,417	748	333	243	711	641
−7	1,397	738	328	239	701	632
	1,376.5	727	323.5	236	691	622.5
−8	1,356	716	319	233	681	613
	.....	.....	314	229	671	604
−9	.....	.....	309	226	661	595
	.....	.....	305	222	651	586
−10	.....	.....	300	219	641	577
	.....	.....	295	216	631	568
−11	.....	.....	291	212	621	559
	.....	.....	286	209	611	550
−12	.....	.....	281	205	601	541
	.....	.....	276.5	202	591	531.5
−13	.....	.....	272	199	581	522
	.....	.....	267	195	571	513
−14	.....	.....	262	192	561	504
	.....	.....	258	188	551	495
−15	.....	.....	253	185	541	486
	.....	.....	248	182	531	477
−16	.....	.....	244	178	521	468
Ma-Mi	402	212	94	68	200	182
Gd	40.2	21.2	9.4	6.8	20	18.2
Gd/2	20.1	10.6	4.7	3.4	10	9.1

total sample, and Table 3 lists the average values for all dimensions in the different regions considered.

The successive preparation of the data was carried out according to the customary anthropometrographic method. This makes it possible to obtain a very large number of types of differential diagnoses from a small number of guiding diagnoses: six (restricted system) with regard to the morphy (paralongi-, parameso-, parabrevilineal between the harmonics; dolicho-, meso-, and brachytypes between the disharmonics) and three for the somy (mega-, meso-, microsomes); the two (morphy and somy) combined provide, consequently, eighteen different cases. But the types of groups (arrangements with repetition) of partial diagnoses, in classes of six, and taking into account the five types of partial diagnoses, total 15,625, permitting valid representation of individual variability.

Table 3. Average measurements corresponding to the regional basomorphs

Region	St tt	St sd	Dt Tc	Dt Bc	Pm Tc	Pm Dd
Piedmont	1,715	900	392	281	838	761
Lombardy	1,711	899	393	279	838	758
Venetia	1,688	894	393	281	849	767
Emilia	1,711	878	395	284	847	768
Tuscany	1,711	900	395	283	850	771
Marches	1,685	885	391	278	843	767
Abruzzi	1,676	888	391	280	852	777
Latium	1,694	895	396	280	849	767
Campania	1,655	876	388	277	840	761
Puglia	1,656	880	387	275	835	752
Basilicata	1,639	917	386	275	836	761
Calabria	1,656	878	385	275	830	747
Sicily	1,651	863	385	275	838	751
Sardinia	1,646	899	381	274	830	744
General BB	1,678	886	394	287	841	759

We must emphasize the presence in the above list of three types with a central trend: paramesolineal, the closest to average normality, taken in a wider sense than the ideal and theoretical one, represented by our basomorphs (symbol BB) which correspond (each for a sample or a population) to Quételet's average statistical individual; finally mesotypes which, as we know, indicate disharmonic subjects in which neither the trend to the longilineal form nor that toward the brevilineal prevails.

The main results of our survey will be found in Tables 1 through 4 and Figures 1 through 6.

Among others, the minimum and maximum figures in the regional basomorphs are evident (Table 3): Basilicata (1,639) and Piedmont (1,715) for St tt; Sicily (863) and Basilicata (917) for St sd; Sardinia (381) and Latium (396) for Dt Tc; Sardinia (274) and Emilia (284) for Dt Bc;

Table 4. Diagnoses relative to regional basomorphs

Region	Partial diagnoses						Guiding diagnoses
Piedmont	=	Lo	Br	=	Lo	Lo	paramesolineal mesomorphs
Lombardy	=	Lo	Br	Lo	Lo	Lo	paralongilineal mesomorphs
Venetia	=	Lo	Br	Br	Br	Lo	paramesolineal megamorphs
Emilia	Lo	Lo	Br	Br	Lo	Lo	paralongilineal mesomorphs
Tuscany	=	Lo	Br	Br	=	Lo	paramesolineal megamorphs
Marches	Lo	Lo	Br	Br	Br	Lo	paramesolineal mesomorphs
Abruzzi	Br	Lo	Br	Br	Br	Lo	parabrevilineal mesomorphs
Latium	=	Lo	Br	=	Br	Lo	paramesolineal megamorphs
Campania	Br	Lo	Br	Br	Br	Lo	parabrevilineal micromorphs
Puglia	Br	Lo	=	Br	Br	Lo	paramesolineal micromorphs
Basilicata	Bra	Lo	Br	Br	Br	Dol	parabrevilineal micromorphs
Calabria	Br	Lo	Lo	Br	=	Lo	paramesolineal micromorphs
Sicily	Lo	Lo	Lo	Br	Br	Lo	paralongilineal micromorphs
Sardinia	Br	Lo	Lo	Br	=	Dol	paramesolineal micromorphs

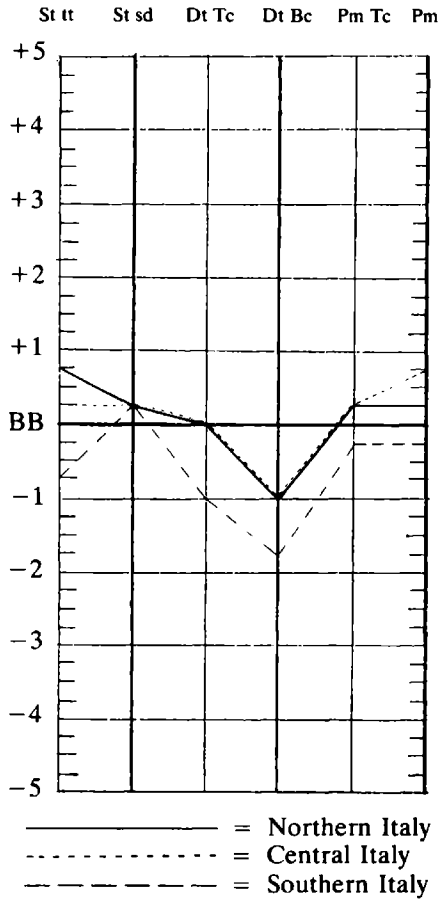


Figure 3. Anthropometrograms of northern, central, and southern Italian basomorphs

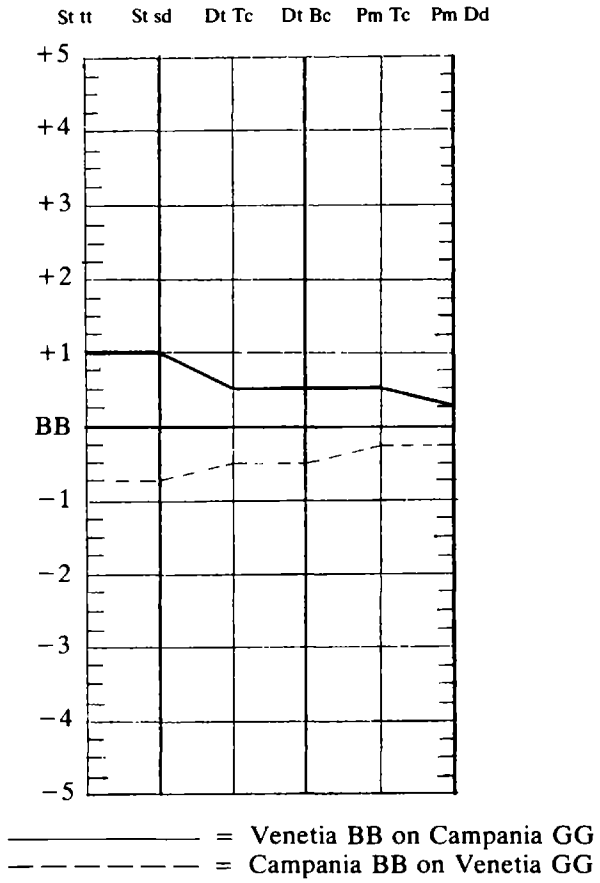


Figure 4. Crossed anthropometrograms: Venetia and Campania

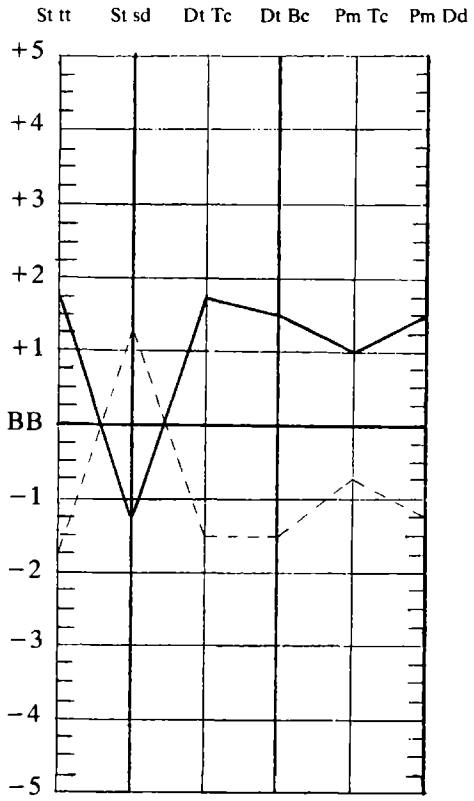
Sardinia, with Calabria, (830) and the Abruzzi (852), for Pm Tc; and finally Sardinia (744) and the Abruzzi (777) for Pm Dd.

Generally speaking, the tables and figures are sufficient to emphasize the differential characteristics of the various regions. It is important, however, to point out that the relative antitheses which arise from the differential diagnoses by the regional basomorphs of the north (tendency toward longiliny) and of the south of Italy (tendency toward breviliny) (Table 4) are very clear in Figure 3 and are confirmed by the crossed anthropometrograms in Figures 4, 5, and 6. Also interesting is the demonstration (Table 5) of the clear prevalence — 75.4 percent — of harmonic subjects (harmony in its widest sense) and among them, of the paralongilineal (18.2 percent) and paramesolineal micromorphs (14.3 percent); also evident is the smaller frequency (0.99 percent) of mesotype mesomorphs among the disharmonics.

In conclusion, we hope that constitutional research will become an increasingly important area of research, not only as it contributes to general scientific knowledge of human populations, but also because of the practical importance of relative diagnoses.

Table 5. Individual anthropometrographic type frequencies

	Megamorphs		Mesomorphs		Micromorphs		
	number	percent	number	percent	number	percent	
Harmonics							
Paralongilineal	518	7.4	376	5.3	1,283	18.2	
Paramesolineal	571	8.1	331	4.7	1,013	14.3	
Parabrevilineal	476	6.5	194	2.7	582	8.2	
Total harmonics:							
number							5,344
percent							75.4
Disharmonics							
Dolichotypes	144	2.1	286	4.1	400	5.7	
Mesotypes	133	1.9	70	0.99	137	1.9	
Brachytypes	297	4.2	142	2.01	123	1.7	
Total disharmonics:							
number							1,732
percent							24.6



———— = Emilia BB on Sardinia GG
— — — — — — = Sardinia BB on Emilia GG

Figure 5. Crossed anthropometrograms: Emilia and Sardinia

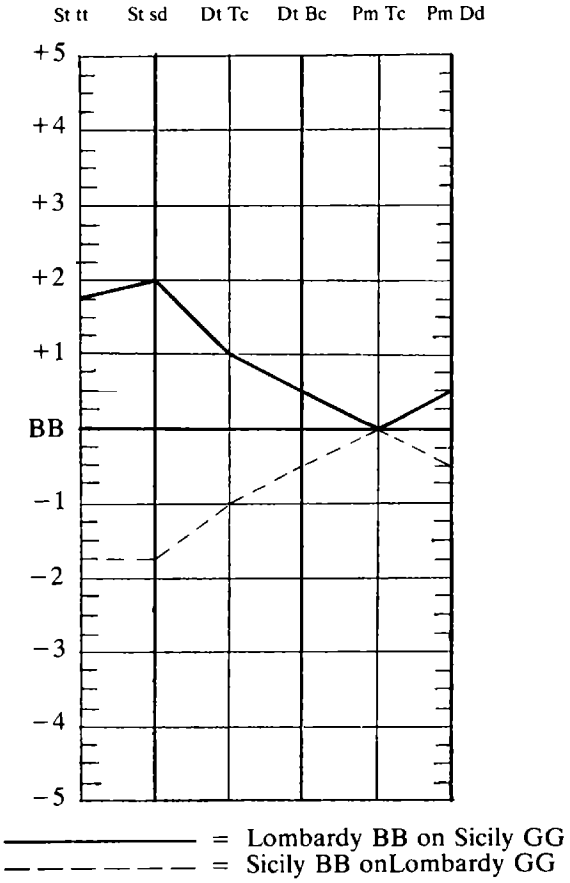


Figure 6. Crossed anthropometrograms: Lombardy and Sicily

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Some Anthropological Research Among the Ladine Populations of the Trentino–Alto Adige, Italy

CLETO CORRAIN and MARIANTONIA CAPITANIO

We present here the partial results of some research carried out among the populations of three Ladine valleys, Fassa, Badia, and Gardena. The object of the research was to study the eventual selective effect of some residual languages, which by convention are classified as part of the same interrelated group of the Ladines. We do not wish to interfere with the research of the glottologists, even to find some hemotypological or anthropometrical evidence in support of certain hypotheses; for instance, to prove the existence of a particular affinity between the so-called Ladines, independently of the valleys in which they live, or to prove the existence of a greater similarity between the Ladines and the non-Ladine inhabitants of the same valley, with whom matrimonial mingling would no doubt have been easier. But we can accept the hypothesis that the actual Ladine represents in the first place the preservation of the linguistic phases for the most part overcome in northern Italy, taking the position of Pellegrini (1968:329), who sees in the spoken language of the Ladines a survival not of the Rhaeto-Romanic, but rather of a more generic cisalpine Gaul-Romanic. This would support the underlying thesis of this entire inquiry: that a certain degree of genetic isolation exists. On the other hand, the topographic contiguity of the peaks of the aforementioned valleys and the consequent difficulty of crossing the passes certainly did not favor more intense matrimonial mingling among the Ladines of the different valleys than between Ladines and non-Ladines of the same valley, despite the eventual linguistic barrier.

We have aimed, above all, at classifying native subjects both of whose parents come from places in the valleys in which, according to the local population, a Ladine language is spoken; secondly, for comparison and

This research work was carried out thanks to contributions from the C.N.R.

contrast, we have classified subjects coming from other localities of the same valleys, considered (correctly or incorrectly) foreign to Ladine linguistic types.

Our long-term research plan is still in a preliminary stage. We have carried it out in two places in Val di Fassa (Soraga and Vigo), in two in Val Badia (St. Cassiano and Villa), and in one in Val Gardena (Selva). The partial results have been reported in some detailed publications (Corrain et al. 1970). We intend to sketch a statistical treatment of the first results in order to examine the differences between these first samples of the three valleys under consideration. (In future we will also consider data from a fourth valley, Livinallongo.)

The relative mean values of some measurements and the classic anthropometric indexes are shown in Table 1.

The stature of males is more than discrete in the three valleys, with a mean value almost identical in Val di Fassa (169.7 centimeters) and in Val Gardena (170.3), and perceptibly less than the mean value in Val Badia (172.2). In Val Badia the cormic index is low, a mean value (males: 48.7) reflecting pronounced macroskelia; the macroskelic feature is reduced in Val Gardena (50.2) and disappears in Val di Fassa, where the mean value (51.4) indicates initial mesatiskelia. On the whole these Ladines tend (contrary to what one would expect) toward large proportions. In the same order come the values of the baric index: Val Badia (1.31), Val Gardena (1.38), Val di Fassa (1.44). Because the subjects are adults, we observe a certain relative reduction of weight, which, consistently, is greater in Val Badia.

The head is rather long (male data) in the three valleys and therefore not flattened around the occiput; it appears moreover concordantly broad, but not so broad that the horizontal cephalic indexes indicate a definite brachycephalic condition. We have here mean values very close to those of initial brachycephalia (82.5, 82.8, 82.0). We may also say that brachycephalia seems to have diminished among the Ladines in the last two centuries (Tappeiner 1883). The height of the head, almost identical in Val di Fassa (117.6 centimeters) and in Val Gardena (119.0), increases perceptibly in Val Badia (125.4). This brings about a change in the relative indexes. The height–length indexes are as follows: Val di Fassa: 62.7, Val Gardena: 63.4, Val Badia: 66.1. That is, in every case the heads are relatively high, but in Val Badia they are very high.

The faces are relatively long (male data), contrary to expectation in the Alpine areas; the mean values of the three samples are mesoprosopic, perhaps final: Val di Fassa (86.6), Val Gardena (85.7), Val Badia (88.2). There is a perceptibly unusual value in Val Badia, where the faces are longer and also narrower. The noses are highly leptorrhine in Val Badia (index 60.5) and in Val di Fassa (index 62.4), but less so in Val Gardena (index 68.5).

Table 1. Relative mean values of some measurements and indexes

		(No.)	Male	(No.)	Female
Stature (in centimeters)	Val di Fassa	(68)	169.7	(37)	158.1
	Val Badia	(14)	172.2	(4)	165.7
	Val Gardena	(25)	170.3	(10)	158.5
Cormic index	Val di Fassa	(68)	51.4	(36)	52.8
	Val Badia	(14)	48.7	(4)	50.1
	Val Gardena	(25)	50.2	(10)	52.5
Weight (in kilograms)	Val di Fassa	(68)	70.2	(37)	62.2
	Val Badia	(14)	67.5	(6)	64.5
	Val Gardena	(25)	66.1	(11)	54.0
Baric index	Val di Fassa	(68)	1.44	(37)	1.58
	Val Badia	(14)	1.31	(4)	1.37
	Val Gardena	(25)	1.38	(10)	1.36
Length of head	Val di Fassa	(69)	187.9	(62)	179.3
	Val Badia	(16)	189.5	(9)	183.0
	Val Gardena	(32)	188.3	(17)	179.3
Breadth of head	Val di Fassa	(69)	154.9	(62)	149.3
	Val Badia	(16)	156.8	(9)	149.3
	Val Gardena	(32)	154.5	(17)	146.3
Horizontal cephalic index	Val di Fassa	(69)	82.5	(62)	83.3
	Val Badia	(16)	82.8	(9)	81.4
	Val Gardena	(32)	82.0	(17)	81.7
Height of head	Val di Fassa	(69)	117.6	(60)	110.7
	Val Badia	(15)	125.4	(9)	118.8
	Val Gardena	(31)	119.0	(15)	114.7
Height–length index	Val di Fassa	(69)	62.7	(60)	62.0
	Val Badia	(15)	66.1	(9)	64.8
	Val Gardena	(31)	63.4	(16)	64.2
Facial index	Val di Fassa	(69)	86.6	(61)	84.8
	Val Badia	(14)	88.2	(9)	84.7
	Val Gardena	(31)	85.7	(16)	85.2
Nasal index	Val di Fassa	(69)	62.4	(61)	61.2
	Val Badia	(14)	60.5	(9)	61.5
	Val Gardena	(31)	68.5	(16)	63.8

On the basis of the foregoing metrical data, we have concluded that there is a substantial concordance among the three samples: the remarkable stature, the slender proportions, the moderately brachycephalic and rather high heads, the rather long and narrow faces, the highly leptorrhine proportions of the nose. The sample from Val Badia seems to differ somewhat from the others insofar as some of the reported features are accentuated, but only a few measurements were carried out there.

The samples are more consistent in regard to the hemotypological characteristics. The following shows the frequencies of ABO blood groups (with the percentages beside them) which were observed in the valleys studied:

	Subjects	A	B	AB	0
Val di Fassa	165	59(35.7)	9(5.5)	1(0.6)	96(58.2)
Val Badia	83	36(43.4)	9(10.8)	1(1.2)	37(44.6)
Val Gardena	108	42(38.9)	4(3.7)	3(2.8)	59(54.6)

Only subjects both of whose parents came from one of the three valleys were taken into consideration. The distribution of phenotypes of the system ABO is similar in Val di Fassa and Val Gardena. Both valleys are characterized by singularly low percentages of the B group (5.5 and 3.7 percent). But there is a very high preponderance of the phenotype 0 (58.2 and 54.6 percent), while 35.7 and 38.9 percent of the subjects in the two valleys have phenotype A. The distribution of the same blood groups in Val Badia (which is least isolated of the three valleys) is apparently not only different from that in the other two valleys but has values that are not unusual in the Venets. We shall look for an explanation of this point in statistical analysis later.

The discussion can be simplified by considering the genic frequencies (p, q, r), for which the significance of the differences (d) of their sum and the total can be examined. This difference is not systematic in any sample:

	p	q	r	d	σd	$d/\sigma d$
Val di Fassa	0.202	0.031	0.763	0.004	0.005	0.800
Val Badia	0.256	0.062	0.668	0.014	0.012	1.167
Val Gardena	0.236	0.033	0.739	0.008	0.221	0.380

The double value of the gene B in Val Badia (0.062) in comparison with the other two valleys (0.031 and 0.033) is apparent. But in Val Gardena the proportions of genes A and O (0.236 and 0.739) appear to be closer to those of Val Badia (0.256 and 0.668) than to those found in Val di Fassa (0.202 and 0.763).

The following figures represent the phenotype frequencies of the subgroups of group A with the percentages of the total of the group in parentheses:

	Total A	A_1	A_2
Val di Fassa	59	44(74.6)	15(25.4)
Val Badia	36	28(77.8)	8(22.2)
Val Gardena	42	29(69.0)	13(31.0)

The percentages of the subgroup A_2 are very close to one another and agree with much European data.

In the distribution of the types of the system MN, however, we find unusual frequencies. There is a high increase of the gene M and a

corresponding reduction of the gene N; this phenomenon is somewhat less pronounced in Val Gardena:

	Subjects	M	N	MN	gene M	gene N
Val di Fassa	165	104(63.0)	9(5.5)	52(31.5)	0.787	0.212
Val Badia	80	50(62.5)	10(12.5)	20(25.0)	0.750	0.250
Val Gardena	107	44(41.1)	18(16.8)	45(42.1)	0.622	0.378

In order to avoid equivocation, we must mention that the distributions of the phenotypes in two of the three samples (the most numerous) do not differ in a systematic way from the distributions which would be predicted on the basis of the Hardy-Weinberg law: $\chi^2 = 0.383$ in Val di Fassa, and $\chi^2 = 1.289$ in Val Gardena against a critical χ^2 (for one degree of freedom [d.f.]) of 3.841. The singular shifting in favor of gene M in Val di Fassa (0.787) and in Val Badia (0.750) is an interesting result. But no less important is the sharp differentiation of the Val Gardena sample (0.622), in which the above shifting is less marked. This differentiation will be seen to be statistically significant.

The research on the antigenes of the system Rh (CDE) was carried out with five antiserums, in order to be able to individuate theoretically eighteen phenotypes; in fact we actually discovered twelve. Moreover we started in the Val di Fassa with four antiserums, not having any anti-e at our disposal at the time. To simplify matters, we shall first consider the distribution of the phenotypes Rh+ and Rh−, that is, of the responses to the serum anti-D:

	Subjects	Rh+	Rh−
Val di Fassa	165	113(68.5)	52(31.5)
Val Badia	83	60(72.3)	23(27.7)
Val Gardena	108	101(93.5)	7(6.5)

The convergence of the high percentages of Rh− in the samples of Val Badia (27.7) and the divergence of the sample of Val Gardena, which is differentiated by a low percentage of Rh− (6.5), is obvious. This is seen to be statistically significant, reflecting a different hemotypological characterization in the sample of the Ladines of this valley.

Let us proceed to a consideration of the single phenotypes, shown in Table 2. In addition to confirming what was said above about the phenotypes Rh−, the figures here show that two of these phenotypes, which are considered rare (ccdEe and ccdEE), make up one-fourth of the Rh− in Val di Fassa and 7.9 percent of the total number; they very rarely appear in the other two valleys. The complex of the phenotypes conditioned also by the gene E is 28.5 percent in Val di Fassa, 15.7 percent in Val Badia, and 20.4 percent in Val Gardena. We deduce from this that the presence of the gene E is rather frequent among the Ladines, particularly among

Table 2. Single phenotypes (numbers followed by percentages, where meaningful)

	Val di Fassa	Val Badia	Val Gardena
ccdee	37(22.4)	19(22.9)	6(5.6)
Ccdee + CCdee	2	3	—
ccdEe + ccdEE	13(7.9)	1	1
ccDEe + ccDEE	18(10.9)	5(6.0)	9(8.3)
CcDee	52(31.5)	29(34.9)	38(35.2)
CCDee	24(14.5)	18(21.7)	42(38.9)
CcDEe + CcDEE	16(9.7)	7(8.4)	12(11.1)
ccDee	3(1.8)	1	—
Total	165	83	108

those of Val di Fassa. It is almost certain that the phenotypes conditioned also by the gene C reach a much higher percentage in Val Gardena (85.2 percent) than in the Valleys di Fassa (57.0 percent) and Badia (68.7 percent). We might have assumed as test of the phenomenon the frequencies of the phenotype CCDee: 14.5 percent in Val di Fassa; 21.7 percent in Val Badia; 38.9 percent in Val Gardena. On the whole it is Val Gardena that differs, even if a certain tendency toward an intermediate position in the distributions of phenotypes is observed in Val Badia. We prefer not to present the calculus of the genic frequencies until completion of our research makes possible more accurate calculations.

Even the distributions of the seric groups Hp seem to differentiate the sample of Val Gardena from those of the other two valleys:

	Subjects	Hp1-1	Hp2-2	Hp2-1	gene Hp^1	gene Hp^2
Val di Fassa	136	19(14.4)	44(32.3)	73(53.7)	0.412	0.588
Val Badia	79	8(10.1)	29(36.7)	42(53.2)	0.367	0.633
Val Gardena	107	3(2.8)	56(52.3)	48(44.9)	0.252	0.748

The gene Hp has frequencies in Val di Fassa (0.412) and in Val Badia (0.367) which are normal for Europe. It registers, however, a clearly lower (even in an absolute sense) frequency in Val Gardena (0.252). In each sample the distribution does not differ (in a systematic way) from that predicted by the law of Hardy-Weinberg: $\chi^2 = 2.521$ (Val di Fassa); 1.221 (Val Badia); 1.289 (Val Gardena), against a critical χ^2 (for one d.f.) of 3.841.

STATISTICAL EVALUATION OF SOME DATA FOR COMPARISON OF THE SAMPLES[1]

As to the distribution of the phenotypes of the system ABO, the group AB is disregarded in the analysis because of its low frequency and also because it does not seem to contribute to any meaningful discrimination. The homogeneity analysis of the distributions of the groups in the three valleys has resulted in $\chi^2 = 6.85$ with four d.f. This value, which is not significant, suggests a substantial homogeneity of the distributions in the three areas. However, a visual examination of the data shows a lower value for the frequency of group O in Val Badia than in the other two valleys.

In fact, a comparison between group O and a combination of the other groups in the valleys di Fassa and Gardena brings us to $\chi^2 = 0.144$ with one d.f., not a significant value; but an analogous comparison, orthogonal to the preceding one, between Val Badia and the other two valleys together, brings us to a $\chi^2 = 3.96$ with one d.f., which is significant (95 percent) and indicates a discrepancy in the distributions of the blood groups in the valleys examined. The conclusion connected with the global analysis may be attributed to the not-very-high numbers of the three samples and to the effect of compensation due to the four degrees of freedom.

As to the subgroups A_1 and A_2, the analysis of the global distributive homogeneity regarding the three valleys yields $\chi^2 = 0.802$ with two d.f. The low value reached supports the hypothesis of homogeneity and discourages any more detailed analysis.

An initial visual examination of the data on the system MN reveals two outstanding features: the relatively low frequency of the phenotype N in Val di Fassa and the even lower frequency of the phenotype M in Val Gardena. At any rate, a first global analysis of distributive homogeneity of the phenotypes in the three valleys yields $\chi^2 = 18.91$ with four d.f. This high value (significant at 99.9 percent), which supports the hypothesis of nondistributive homogeneity, provides an incentive to proceed to further analyses.

Let us first analyze the behavior of the phenotypes M and MN in the samples of the Valleys di Fassa and Badia. We obtain $\chi^2 = 0.505$ with one d.f., an insignificant value. If we now put the two samples together and compare them with the sample of Val Gardena, we obtain $\chi^2 = 9.57$ with one d.f. The high value of this test (significant at 99 percent) confirms the second of the two impressions reported above, that is, that the percentage of the phenotype M in Val Gardena is low in comparison with that in the other two valleys.

[1] This evaluation for comparison of samples from the three valleys was conducted by Fortunato Pesarin.

In the same way, in order to analyze the behavior of the phenotype N in the three samples, we can take the phenotypes M and MN together. Comparing the distribution of these phenotypes in the samples of the Valleys di Fassa and Gardena, we obtain $\chi^2 = 9.38$ with one d.f. The high value of the test (significant at 99 percent) supports the first impression, that the frequency of the phenotype N in Val di Fassa is relatively low. In order to complete the analysis, the behavior of the phenotype N in Val Badia must be studied. Combining the data of Val di Fassa with those of Val Gardena and repeating the analysis of the distributions of the phenotype N and M + MN, we obtain $\chi^2 = 0.435$ with one d.f. This last value, not significant, proves that the behavior of phenotype N in Val Badia differs from that in both the other two valleys.

We come now to the phenotypes Rh+ and Rh− of the system Rh (CDE). An initial visual examination reveals the low percentage of Rh− in Val Gardena in comparison with the other two valleys. A preliminary global analysis of the distributive homogeneity brings us to $\chi^2 = 24.41$ with two d.f. (significant at 99.9 percent). Dividing the global analysis into two orthogonal analyses, we obtain first a comparison between the samples of the Valleys di Fassa and Badia, which yields $\chi^2 = 0.379$ with one d.f. (not significant); and, second, a comparison between the sample of Val Gardena and the samples of the other two valleys taken together, which yields $\chi^2 = 23.96$ with one d.f. (significant at 99.9 percent). The last result allows us to confirm our initial observation that the sample of Val Gardena has a distribution of the phenotypes Rh+ and Rh− that differs clearly from the distributions of the other two samples, which are practically the same.

Considering all the phenotypes of the system Rh (CDE), two points appear very distinctly: (1) Val Gardena seems to differ from the other two valleys (which have very similar phenotype frequency distributions) in terms of its very low frequency of the assemblage (ccdee + Ccdee + CCdee + ccdEe + ccdEE) and its high frequency of the phenotype CCDee; (2) the other phenotypes tend to be distributed in a clearly similar way in the three valleys.

It is unnecessary to give the global analysis, given the almost obvious result. However, it gave us $\chi^2 = 37.368$ with eight d.f., which is a significant result at 99 percent. (The distribution analysis of the samples of the Valleys di Fassa and Badia yielded $\chi^2 = 3.632$ with four d.f. As this represents a value very much lower than the critical value, it confirms the impression that emerged regarding the great distributive similarity between the two samples. Moreover, it also indirectly confirmed the impression that the distribution of the sample of Val Gardena is responsible for the great differences that appeared.)

We will now test the second impression that emerged from the analysis of the phenotype distribution ccDEe + ccDEE, CcDee, and CcDEe +

CcDEE. We obtain $\chi^2 = 2.023$ with four d.f., which does not appear to be significant. There is therefore nothing left to do but to verify what we can consider already indirectly confirmed, that is, that the distributive difference between the samples is entirely due to the phenotypes described above.

Combining now all the phenotypes of the preceding comparison and pooling the information on the samples of the Valleys di Fassa and Badia, we may compare the frequency of the phenotype CCDee in those two valleys with that found in Val Gardena. We obtain $\chi^2 = 8.258$ with one d.f., which is significant at 99 percent. This indicates that the phenotype CCDee is present in Val Gardena with a significantly higher frequency than it is in the other two valleys. It remains to test the distribution of the complex of phenotypes: ccdee + Ccdee + CCdee + ccdEe + ccdEE. With this intent, we have compared the data on the combination of phenotypes in Val Gardena with those in Val Badia and Val di Fassa together, with all the other phenotypes combined. We obtained thereby $\chi^2 = 24.650$ with one d.f., significant at 99.9 percent. And this confirms what was said above.

An initial examination of the seric system Hp revealed low frequency of the phenotype Hp 1-1 and high frequency of the phenotype Hp 2-2 in the Val Gardena sample; the other two samples are almost exactly alike. The first global analysis yields $\chi^2 = 15.41$ with four d.f. (a value significant at 99 percent), which supports the hypothesis of a distributive inhomogeneity of the phenotypes of the system Hp in the three valleys.

To make a more detailed analysis, we divided the global analysis into four orthogonal components, which testified to the differences that were appearing. We shall consider first a comparison of the distributions of the phenotypes Hp 1-1 and Hp 2-1 taken from the samples of the Valleys di Fassa and Badia. We obtain $\chi^2 = 0.455$, with one d.f., an insignificant value. In the second place, still referring to the above phenotypes, we consider a comparison between the samples of Val Gardena and the other two together. We obtain $\chi^2 = 4.93$, with one d.f. This value (significant at 95 percent) confirms the impression given us by the lower percentage of the phenotype 1-1 in Val Gardena.

Proceeding with our analysis, we now consider the behavior of the phenotype Hp 2-2 in the three valleys, taking into account first a comparison of the phenotype distributions Hp 2-2 and 1-1, and Hp 2-1, in the Valleys di Fassa and Badia. We obtain $\chi^2 = 0.423$, with one d.f. (not significant), which again shows the distributive similarity in the three valleys. A second comparison, however, between the sample of Val Gardena and those of the other two valleys combined, with reference to the same phenotypes, yields $\chi^2 = 10.05$ with one d.f., significant at 99.9 percent. This confirms our first impression. Again the sample from Val

Gardena differs, from a hemotypological point of view, from the samples of the other two valleys, which are very much alike.

CONCLUSIONS

We are reporting these first results as tentative because more ample samples from the three valleys under study are necessary. We may affirm, however, that for certain important aspects (e.g. distribution of the blood groups of the systems MN, Rh, and Hp), the Ladines of Val Gardena differ from the Ladines of Val di Fassa and Val Badia. In the latter two there is also a relatively high frequency of the phenotype M as compared with the frequency of the phenotype N. The frequency of phenotype N, however, in the Val Badia sample assumes an intermediary, significant position between the other two samples.

In particular, the percentages of Rh− in Val di Fassa and Val Badia are high, whereas its percentage in Val Gardena is singularly low. The gene Hp^1 reaches frequencies in Val di Fassa and Val Badia which are normal among European populations; its frequency in Val Gardena is decidedly modest.

An investigation of the distribution of the phenotypes of the system ABO reveals that the samples from the Valleys di Fassa and Gardena are characterized by high frequencies of the group O in comparison with the group A and by very low frequencies of the group B. The distribution in Val Badia seems very different and rather usual. Statistical confirmation of this fact is not entirely lacking. The internal proportions of the subgroups A_1 and A_2 are identical in all three valleys.

The nonnegligible somatic characteristics of the Ladines of Val Gardena seem to fall into an intermediary position between the Ladines of the other two valleys, being more similar to those of Val di Fassa. But given the small number of samples, we cannot, at present, seek a statistical confirmation of this fact.

Because of the lack of space, we have not reported much of our serological quantitative data. For information on that subject, we advise our readers to refer to the analytical works published. Hence it will suffice to report the apparent distinction between the Val Gardena sample and the samples of the other two valleys.

Future papers, which will take into account data on the Ladines of the Valle di Livinallongo and which will be able to make use of more numerous samples from the four valleys (independently of the actual languages), will show the curious developments of scientific thought that almost certainly will be the result of the investigations. It was not an idle thought of ours to speak of populations (in the plural) or of the inhabitants of the same valley.

We believe (we are not saying "hope") that, when the argument is closed, a glottological pretext will have inspired interesting, even if unforeseen, developments.

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Digital Dermatoglyphics: Quantitative Aspects in the Population of Seven Sardinian Communities

CARLO MAXIA, GIOVANNI FLORIS, and GIUSEPPE VONA

The study of chyrodactyl (or digital) dermatoglyphics can be developed along two lines: its qualitative aspects and its quantitative aspects.

It is the quantitative aspects that have allowed us to approach the heredity of dermatoglyphics with greater precision. In actual practice the quantitative method for chyrodactyl dermatoglyphics consists in the total digital ridge count (TRC) and the pattern-intensity or Cummin's index (PI).

The first of these two methods that has allowed the formation of a hypothesis of polyfactorial determination of character (Holt 1949) consists of calculating the number of ridges that intersect the straight line joining the triradius with the center of the pattern that is present in the fingertip. By definition the arch has no count, as it has no triradii; the loop has a possibility of count, having one triradius; the whorl which is outlined by two triradii has two counts, of which the greater is chosen as standard procedure (Cummins and Midlo 1961; Holt 1968; Mavalwala 1973; Weninger 1973). The total ridge count of a subject generally varies from 0 to 300.

The second quantitative characteristic indicates the mean number of triradii present in a subject (or those present per finger).

These two are the only correlated quantitative dermatoglyphic characteristics (Vrydagh-Laoureux 1971), in so far as the whorls, usually with the greater number of ridges, also have more triradii, and, vice-versa, the arches that have no ridge count have no triradii.

Given the importance that quantitative characteristics hold for dermatoglyphics in characterizing the various ethnoracial groups as, for example, two of us showed for the palmar a–b ridge count (Maxia and Floris 1974), we decided to examine the quantitative aspects of chyro-

dactyl dermatoglyphics in Sardinians.[1] The qualitative aspects of these dermatoglyphics have been examined through a wide scope of data (more than 34,000 subjects were tested) and have shown the particular behavior of the single countries tested (Maxia, Fenu, and Floris 1972; Maxia and Fenu 1973).

The Sardinians have in fact a particular anthropological interest, as they are divided into a large number of groups which, owing to centuries of isolation and subsequent endogamy, differ either somewhat or greatly among themselves (Maxia 1949, 1959, 1960, 1971).

Here we give the data relative to the quantitative test of chyrodactyl dermatoglyphics in 1,259 subjects (681 males and 578 females) belonging to seven Sardinian communities (Dolianova, Guasila, Guspini, Lanusei, Serdiana, Serrenti, Sinnai).

RESULTS

Total Digital Ridge Count (TRC)

This characteristic can be tested in two ways: either by taking into account all persons in whom this characteristic was found in all ten fingers, or by counting only the single fingers on which it was found. For the proper application of statistical parameters only the first method is correct.

The TRC of 629 individuals (349 males and 280 females) was examined. Table 1 shows the data relative to the seven areas in which we tested. It can be seen that the TRC varies from 113.41 in the population of Sinnai to 125.72 in that of Guspini. In six out of seven areas males show a value greater than that of females, the only exception being Sinnai, where the opposite occurs.

Statistically the difference has proved significant in three of the seven communities (42.86 percent): Dolianova, Guasila, and Guspini; and nonsignificant in the other four, as can be seen in Table 2.

In all seven communities tested the values of the right side are greater than those of the left (in Serrenti the difference is only 0.52 percent), but this difference is not always significant.

We applied an analysis of variance to all available data to determine whether there were significant differences between the seven communities examined. As can be seen in Table 3, the relationship of the variance is nonsignificant ($F = 0.645$); it is thus the variability within the single group that is greater than that between the groups. Given the result of the analysis we can safely consider the groups as a whole rather than as single entities.

[1] A summary of the results of early work on the quantitative aspects of digital dermatoglyphics can be found in Maxia, Floris, and Vona 1973.

Table 1. Digital ridge count in the seven Sardinian communities examined

		Right			Left			Right + Left		
		M	F	M + F	M	F	M + F	M	F	M + F
Dolianova	(n = 81)	69.22	55.56	63.30	65.92	53.29	59.53	135.15	110.80	122.83 ± 5.452
Guasila	(n = 121)	65.37	57.76	62.85	62.71	52.77	59.50	128.02	110.33	122.69 ± 3.459
Guspini	(n = 114)	70.28	57.53	64.80	66.54	53.47	60.92	136.81	111.00	125.72 ± 4.647
Lanusei	(n = 118)	63.54	57.83	61.39	60.64	53.94	57.91	124.20	110.31	118.55 ± 3.706
Serdiana	(n = 39)	69.07	56.56	61.05	68.00	53.80	58.95	137.07	110.44	119.97 ± 7.144
Serrenti	(n = 88)	63.62	56.60	60.59	63.88	55.05	60.07	127.50	111.68	120.67 ± 5.380
Sinnai	(n = 68)	52.46	60.83	57.38	46.96	56.85	52.78	99.43	117.67	113.41 ± 5.273
Total	(n = 629)							127.70	111.76	121.02 ± 1.790

Table 2. Values of Student's *t* distribution in the comparison of sexes and sides in the seven communities tested

	Total digital ridge count		Pattern intensity	
	M + F	R + L	M + F	R + L
Dolianova	2.29[a]	0.96	2.46[a]	1.20
Guasila	2.32[a]	1.27	1.005	2.19[a]
Guspini	2.83[a]	1.16	1.30	1.56
Lanusei	1.62	1.14	1.20	0.74
Serdiana	1.85	0.41	0.76	0.82
Serrenti	1.47	0.135	1.66	1.24
Sinnai	1.58	1.11	0.18	0.62

[a] These numbers represent t values of significance or great significance.

Table 3. Total digital ridge count: analysis of variance

Source of variation	Deviance	Degree of freedom	Variance	Variance ratio
Between	7826.8458	6	1304.4743	0.645
Within	1258270.7472	622	2022.9333	

In the 629 subjects tested, the TRC averaged 121.02; it was greater in males (127.70) than in females (111.76).

In comparing our data for males with that obtained by other groups (Pereira-da Silva 1971; Ducros and Ducros 1972) it can be seen that Sardinians are similar to 170 French Basques tested for this same characteristic (128.9) and that both have the lowest values to be found in any European group tested.

As for females, they show a value similar to that of a black African group, the Dogon (114.8), and to that of the French Basques (116.2); one must remember that a smaller value than that found in the females is usually found only in Efe pigmies (96.5).

In Figure 1 and Table 4 we show the distribution of this characteristic divided into twenty-two classes, from 0 to 241, form 11. The class with the highest frequency is class 13 (10.81 percent). The curve of frequency distribution is non-Gaussian, with g_1 (skewness) $= -0.334 \pm 0.097$ and g_2 (kurtosis) $= -0.275 \pm 0.1945$, values that are significant for g_1 ($p = 1$ percent) and nonsignificant for g_2.

In Table 5, we see the mean ridge count of individual digits when all the fingers are actually tested ($n = 8{,}801$). The value is 127.33, with a difference as regards the data for the total ridge count of only 6.31.

For all the fingers, male values are higher than female values; while for digits I–II–IV, right-side values are greater than left-side values, and for digits III and V the opposite is the case.

When considering the fingers individually by size according to the mean ridge count for individual digits the order is: I > IV > V > III > II, for both sexes, for both sides, and for the total group.

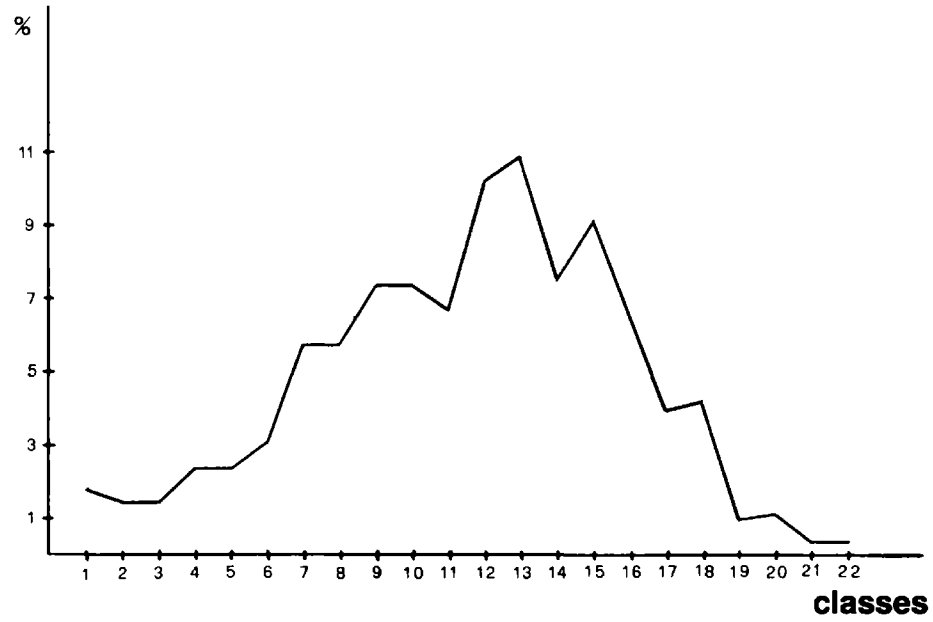

Figure 1. Total digital ridge count in 629 subjects examined (see Table 4)

Table 4. Digital ridge count in the total of subjects examined (n = 629): division into classes (form: 11)

Classes	Absolute frequency	Percent frequency
1 (0–10)	11	1.75
2 (11–21)	9	1.43
3 (22–32)	9	1.43
4 (33–43)	15	2.38
5 (44–54)	15	2.38
6 (55–65)	19	3.02
7 (66–76)	36	5.72
8 (77–87)	36	5.72
9 (88–98)	46	7.31
10 (99–109)	46	7.31
11 (110–120)	42	6.68
12 (121–131)	64	10.17
13 (132–142)	68	10.81
14 (143–153)	47	7.47
15 (154–164)	57	9.06
16 (165–175)	41	6.52
17 (176–186)	25	3.97
18 (187–197)	26	4.13
19 (198–208)	6	0.95
20 (209–219)	7	1.11
21 (220–230)	2	0.32
22 (231–241)	2	0.32

Table 5. Mean ridge count on individual digits of Sardinians

	I	II	III	IV	V
Males:					
Right	18.35 (9031:492)	10.45 (5192:497)	10.99 (5581:508)	14.77 (7059:478)	12.53 (6254:499)
Left	16.53 (8001:484)	9.85 (5014:509)	11.36 (5874:517)	14.84 (7213:486)	12.82 (6463:504)
R + L	17.45 (17032:976)	10.14 (10206:1006)	11.17 (11455:1025)	14.80 (14272:964)	12.68 (12717:1003)
Females:					
Right	16.50 (6269:380)	9.83 (3826:389)	10.45 (4191:401)	13.90 (5199:374)	11.34 (4365:385)
Left	14.24 (5455:383)	9.11 (3526:387)	10.38 (4183:403)	13.65 (4996:366)	11.20 (4020:359)
R + L	15.36 (11724:763)	9.47 (7352:776)	10.41 (8374:804)	13.78 (10195:740)	11.27 (8385:744)
M + F					
Right	17.54 (15300:872)	10.18 (9018:886)	10.75 (9772:909)	14.39 (12258:852)	12.01 (10619:884)
Left	15.52 (13456:867)	9.53 (8540:896)	10.93 (10057:920)	14.33 (12209:852)	12.15 (10483:863)
R + L	16.53 (28756:1739)	9.85 (17558:1782)	10.84 (19829:1829)	14.36 (24467:1704)	12.08 (21102:1747)
					127.33 (n = 8,801)

Pattern Intensity (PI)

This was calculated for 1,259 individuals. The data relative to the single communities are reported in Table 6. The characteristic tested varies from 12.32 in Guasila to 13.18 in Guspini (which also shows the greater number of ridges). In six out of seven communities, males show a greater value than females, but in Sinnai we find the opposite, as was also the case with the total ridge count.

Once statistically processed the differences were significant only in Dolianova (Table 2). In all seven communities tested the values for the right side are greater than those for the left, but the difference was significant only for Guasila.

On applying the analysis of the variance to the mean of the seven communities, Table 7 shows it to be nonsignificant, and thus this characteristic, like the TRC, shows a variability that is greater within the single groups examined than between them ($F = 1.85$).

Of the 1,259 individuals tested, the pattern intensity gave an average value of 12.67, greater in males (12.95) than in females (12.34).

Comparing the total value (exclusive of sex differences) with that of other groups (Pons 1952; Schwidetzky 1966) the value found in Sardinians coincides with those of Great Russians, Ainu, and inhabitants of the Caucasus in Europe and with those of some Mongoloid and Negroid racial groups.

Figure 2 and Table 8 show the distribution of this characteristic in 21 classes (from 0 to 20), form 1. The class with the highest frequency is class

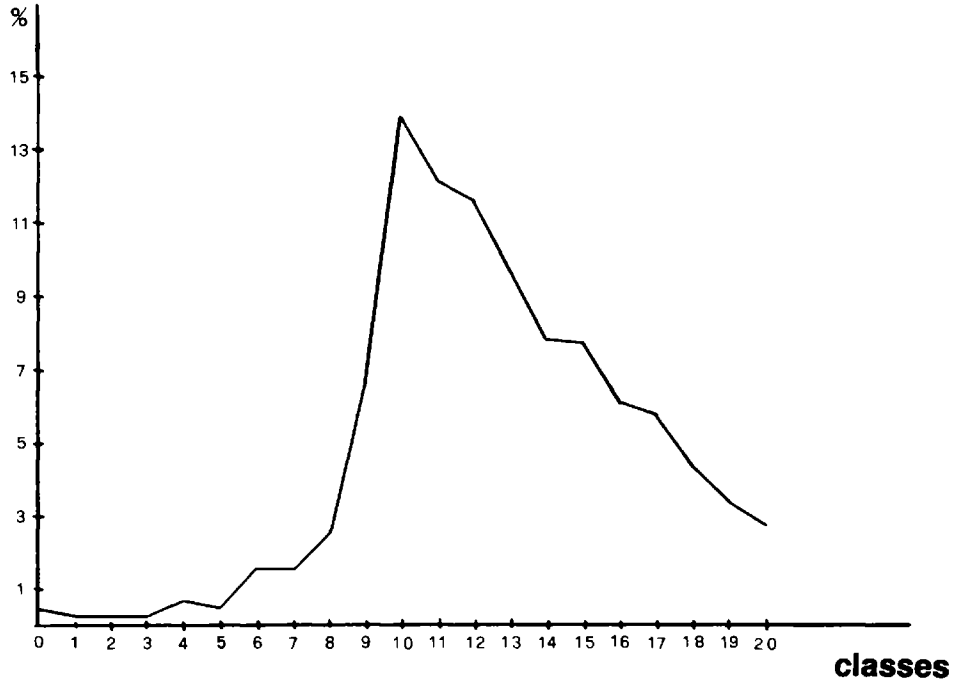

Figure 2. Pattern intensity in 1,259 subjects examined (see Table 8)

Table 6. Pattern intensity in the seven Sardinian communities examined

		Right			Left			Right + Left		
		M	F	M + F	M	F	M + F	M	F	M + F
Dolianova	(n = 150)	6.64	5.99	6.30	6.42	5.71	6.05	13.05	11.69	12.35 ± 0.281
Guasila	(n = 181)	6.54	6.06	6.35	5.96	5.99	5.97	12.50	12.04	12.32 ± 0.230
Guspini	(n = 252)	6.97	6.45	6.72	6.49	6.43	6.46	13.46	12.88	13.18 ± 0.223
Lanusei	(n = 246)	6.69	6.26	6.52	6.45	6.30	6.39	13.14	12.56	12.91 ± 0.237
Serdiana	(n = 84)	6.69	6.35	6.49	6.40	6.14	6.25	13.09	12.48	12.74 ± 0.396
Serrenti	(n = 191)	6.54	5.99	6.32	6.22	5.88	6.08	12.76	11.87	12.40 ± 0.264
Sinnai	(n = 155)	6.40	6.20	6.29	5.98	6.28	6.15	12.38	12.49	12.44 ± 0.306
Total	(n = 1,259)							12.95	12.34	12.67 ± 0.100

Table 7. Pattern intensity: analysis of variance

Source of variation	Deviance	Degree of freedom	Variance	Variance ratio
Between	140.54	6	23.42	1.85
Within	15842.68	1252	12.65	

Table 8. Pattern intensity in the total of subjects examined (n = 1,259): division into classes

Classes	Absolute frequency	Percent frequency
0	5	0.40
1	3	0.24
2	3	0.24
3	3	0.24
4	8	0.63
5	6	0.48
6	20	1.59
7	20	1.59
8	32	2.54
9	83	6.59
10	175	13.90
11	153	12.15
12	147	11.68
13	121	9.61
14	99	7.86
15	98	7.78
16	77	6.12
17	73	5.80
18	55	4.37
19	43	3.41
20	35	2.78

10 (13.90 percent). The curve of frequency distribution is non-Gaussian, with $g_1 = -0.122 \pm 0.069$ and $g_2 = 0.3055 \pm 0.138$, values that are nonsignificant for g_1 and significant for g_2 (p = 5 percent).

If the pattern intensity value is used only from the 349 male subjects used for the total ridge count, the value is then 12.49. The two values allow the group of Sardinians tested to be set on a Cartesian coordinate system graph, Figure 3 (from Ducros and Ducros 1972, modified). The Sardinians fall at the base of the graph, along with the French Basques and the Merina of Madagascar.

Figure 4 shows the field of variability for the pattern intensity index in the major racial groups. The field of variability of the Sardinians is included in that of the Europeans.

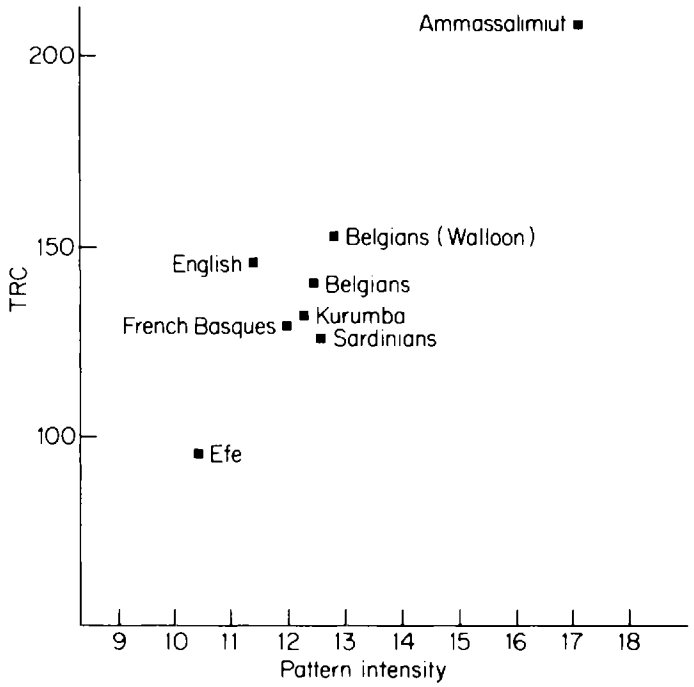

Figure 3. Ratio of total digital ridge count and pattern intensity in some racial groups and male Sardinians

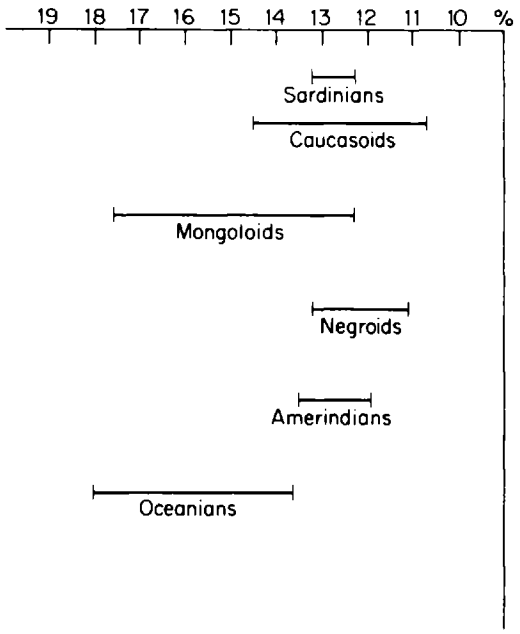

Figure 4. Field of variability for pattern intensity in the major racial groups and in Sardinians

GENERAL CONSIDERATIONS

From the data the following is clear:

1. The two characteristics examined do not seem to be good ethnoracial discriminants. The analysis of variance consistently gives nonsignificant values for comparison between the communities tested.

2. Within each group the two characteristics under examination show a greater variability for the sexes (three out of seven differences are significant for the TRC) than for the sides (only Guasila shows a significant value for pattern intensity). There is the tendency, however, for males to have a greater value than females and for the right side to have a greater value than the left side, both for total ridge count and for pattern intensity.

3. Correlation between the two characteristics (Vrydagh-Laoureux 1971) is confirmed, and they show the same behavior in both sexes and both sides in the groups tested.

4. If the two quantitative characteristics do not seem to be good discriminants of local differences in the same racial groups, they are good discriminants for different racial groups. Sardinians, in fact, are on the whole detached from almost all other European groups tested. But they are in affinity with other isolated and endogamic groups, such as the Ainu and the Basques, that in turn often show characteristics different from those of other Europeans.

SUMMARY

The authors here report data relative to the quantitative testing of digital dermatoglyphics in 1,259 individuals (681 males and 578 females) belonging to seven Sardinian communities.

Both for the total ridge count and for the pattern intensity index, the differences in the means of the single groups tested were statistically nonsignificant. For both characteristics examined males show, with only one exception, greater values than do females. The values for the right side have always been greater than those for the left side.

Sardinians on the whole are detached from almost all other European populations tested but show an affinity with French Basques.

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Distribution of Blood Genes in the Population of the Ukraine

E. I. DANILOVA, L. I. TIMOSHENKO, R. A. STAROVOĬTOVA, and R. A. RUDENKO

In recent years Ukrainian anthropologists and hematologists have attempted to discover how natural and ethnic factors affect the formation of serological complexes in local populations. Their study was based upon serological characteristics, according to the blood groups ABO, shown in Table 1; MN, shown in Table 2; Gm, shown in Table 3; Hp, shown in Table 4; Gc, shown in Table 5; Rh-Hr, shown in Table 6; and to the factors D, C, E, c, and e, shown in Table 7, of local urban and rural populations (Ukrainians, Russians, and some others) in different climato-geographic zones of the Ukraine. Some preliminary data on frequency distribution of various phenotypes and factors of the Rh-Hr system are also presented. These data were correlated with the distribution of anthropological types and with the frequency of the respective genes and factors in the ethnic groups of the neighboring territories.

The general serological characteristics of the Ukrainian population of the Ukrainian Soviet Socialist Republic, according to the genes r (53–65 percent), M (59–62 percent), P+ (70 percent) (the data on Kiev, 1970, presented by M. I. Dudnik), K+ (11 percent) (the data on Kiev, 1970, presented by M. I. Dudnik), Gc^1 (69–71 percent), Hp^1 (46–48 percent), the Gm type (1) (36–39 percent), and Rh-Hr factors, are found to be typical for eastern Europe (Bunak 1969; Danilova 1971a, 1971b; Starovoĭtova 1971), and different from those of most other peoples in western Europe (Watkin 1966; Khérumian and Chevlier 1966; Furfaro 1970; Facchini and Venenevi 1969) and in Asia (Boyd and Boyd 1954; Boyd 1956; Rychkov 1965; Spitsyn 1967; Shabalin 1967; Zolotarëva and Bashlaĭ 1968; Ismagulov and Petrikovets 1969; Gorokhov 1971; Glindeman et al. 1971; Chit' 1960). At the same time fluctuations of frequencies of p(A) and q(B) are rather great, with the readings highest for gene p(A) (36 percent) and lowest for gene q(B) (10 percent)

observed mainly in the zone in which the Ukrainians have ethnic contacts with the populations of the northern Balkan peninsula and those of the banks of the Danube river.

Attention was focused on the forest–steppe zone (up to 300 meters above sea level), the forest area (100–250 meters above sea level), the steppe zone (less than 100 meters above sea level), the Donetsk upland (up to 350 meters above sea level), the Crimea (the highest point above sea level is 1,200 meters; in Simferopol it is 340 meters), and the Carpathian zone (the highest point above sea level is about 2,000 meters, the average height about 1,000 meters).

The populations of each of the climato-geographic zones under study revealed a considerable number of peculiarities, among Ukrainians as well as all others.

THE FOREST–STEPPE ZONE

The frequency fluctuations of the r(O) and p(A) genes are, with those of the q(B) gene, rather small (13 percent) or moderate (16 percent). Hence, it was impossible to differentiate clearly between the populations of this zone and those of central Europe (Necrasova et al. 1964; Teodorescù-Bălteanù and Radu 1971; Zenaida 1969; Rex-Kiss and Norvath 1971) and of eastern Europe (Bunak 1969; Danilova 1971a, 1971b; Starovoĭtova 1971). The data on the genes M (59–62 percent), N (38–41 percent), and P (10 percent) and the frequencies of the antigen $Gm^{(1)}$ (36 percent) are typical for most of the Slav peoples, as well as for Austrians, Italians, and Greeks (Umnova and Prokop 1964; Tumanov and Tomilin 1969; Herzog and Vojtisek 1961; Podliachouk et al. 1961; Bujan and Prokop 1963). The Hp^1 content (47 percent), as in other ethnic groups of eastern Europe, is high and coincides with the frequencies of the factor in the Russians living in the same territory. The Gc^1 frequency (69 percent) is also close to that in the Russians living here (Umnova and Prokop 1964; Tumanov and Tomilin 1969; Herzog and Vojtisek 1961; Podliachouk et al. 1961; Bujan and Prokop 1963).

THE FOREST AREA

The serological peculiarities of the indigenous Ukrainian population here reveal low (with some rare exceptions) frequencies of the p(A) gene (mostly about 20 percent) and, on the contrary, comparatively high frequencies of r(O) genes (60–62 percent), which bring the Ukrainian population of this territory closer to Byelorussians (after Bunak 1969), Lithuanians (Mourant et al. 1958), Poles (Sablinski 1959), and Russians

(Umnova and Prozorovskaia 1965; Gridchik 1970). The concentration of the q(B) gene is higher, as is that in the population of the eastern Pribaltic and in the northeastern part of the European section of the Soviet Union. The frequencies of the genes M, Hp^1, Gc^1, and the type $Gm^{(1)}$ are approximately the same as those in the forest–steppe zone.

THE STEPPE ZONE

The Ukrainian population of this zone, compared with that of other climato-geographic zones of the Ukraine, tends to show higher frequencies of the genes p(A) (25–30 percent), q(B) (18–20 percent), and M (62–68 percent). It may testify to an ancient genetic influence of Iranian and anterior Asian anthropological components (Dan 1970; Nersesian, Shcherbakova, Akopian 1970; Nersesian 1971; Ropartz et al. 1962). At the same time, the frequencies of the genes Hp^1, Gc^1, and the type $Gm^{(1)}$ are typical for the populations of eastern Europe. It has been noted that the distribution of the ABO blood genes in the Bulgarians and Moldavians dwelling in the Odessa region is close to that in the Ukrainian populations (Lavrik et al. 1968), which speaks in favor of their ethnic similarity.

THE CARPATHIAN ZONE

The serological complex of the native population here is most peculiar. It proves the ideas of Soviet anthropologists (Bunak, Diachenko, and others) who distinguished a special morphological type here, called the Carpathian (Diachenko 1965). The most characteristic feature of this type is a considerably higher frequency of the gene p(A) (28–36 percent), with a low (8 percent) or moderate (14 percent) frequency of the gene q(B). This phenomenon is rather frequent for peoples inhabiting alpine regions. The frequencies of the genes M, Hp^1, and Gc^1 are similar to those in other zones of the Ukraine. The $Gm^{(1)}$ concentration is near that found in some peoples of western Europe (Ropartz et al. 1963).

THE CRIMEA

The mixed population (Russians and Ukrainians) of the Crimean region is close in its genic ABO characteristics to that of the population of the steppe zone of the Ukraine. The only difference is in somewhat lower frequencies of the p(A) gene. To a certain extent this contradicts the idea that the frequency of this gene is dependent on the height above sea level.

The local concentrations of the genes M, Hp^1, and Gc^1 are moderate. The frequency of the factor $Gm^{(1)}$ for the population of the Ukraine is higher, but still lower than in the Carpathian zone.

THE DONETSK UPLAND

In its distribution of the ABO blood genes the Ukrainian population of the Donetsk region approaches that of the Russian population of the Stavropol and Krasnodar territories. The Ukrainians and the Russians in the Voroshilovgrad region, with their rather low frequencies of the p(A) gene (17–20 percent), tend to resemble the Russian population of the pre-Ural area (after Danilova). This may be attributed to the Russian migration to the industrial regions of the Donbasin. For both the Ukrainians and the Russians here the genes M, Hp^1, Gc^1, and the type $Gm^{(1)}$ are within modern concentrations typical for the populations of eastern Europe.

CONCLUSIONS

The investigations described here lead to the conclusion that the principal serological complexes in the populations of the Ukrainian Soviet Socialist Republic were formed mainly through intricate ethnic processes. In some cases the distribution of anthropological and serological complexes is obviously interrelated. However, there is no complete coincidence of these territories. A serological similarity between the Ukrainian and most other local ethnic groups in the same territories of the Ukrainian Soviet Socialist Republic has been observed. It can be attributed to their similar ethnic origin and probably also to the influence of similar environmental conditions.

The highest concentration of the gene p(A) was found in the highest part of the territory of the Republic, namely, in the Carpathians. At the same time, any correlative links between the height above sea level and the frequency of this gene in other territories of the Ukraine have not been observed.

Key to Tables 1–6

The following investigators are the sources of the information in the Tables: [a]Danilova and Diachenko; [b]Lavrik, Karavanov, Danilova, Dudnik, and Diachenko; [c]Starovoĭtova; [d]Danilova and Reshetnik; [e]Danilova; [f]Diachenko, Kukhtenko, and Zakharova; [g]Rudenko; [h]Timoshenko and Starovoĭtova; [i]Diachenko and Kukhtenko; [j]Diachenko, Kukhtenko, and Kruts; [k]Rudenko and Timoshenko; [l]Danilova and Timoshenko; [m]Danilova, Diachenko, and Timoshenko; [n]Diachenko; [o]Starovoĭtova and Rudenko; [p]Timoshenko; [q]Rudenko, Timoshenko, and Starovoĭtova; [r]Danilova, Timoshenko, and Starovoĭtova.

Table 1. Distribution of phenotypes and genes of the ABO blood groups

Zone, Ethnic group, territory	Number investigated	Frequency of phenotypes (percentages)				Frequency of genes (percentages)			χ^2	*P*
		O(I)	A(II)	B(III)	AB(IV)	r	p	q		
Forest-steppe Ukrainians of Kiev (city)[a]	565	42.3	35.5	19.0	3.2	65.0	23.2	13.3	6.052	0.01
Russians of Kiev (city)[a]	292	36.4	38.7	20.5	4.5	60.2	26.4	18.0	3.982	0.05
Ukrainians of Kiev region (Mironov district)[b]	621	34.9	37.8	21.5	5.8	59.1	29.2	16.0	3.093	0.05
Ukrainians of Kiev region (Tetievsky district)[b]	228	29.8	42.6	19.3	8.3	54.6	30.5	15.5	0.162	0.70
Ukrainians of Kiev region (Bogdan–Khmelnitsky district)[b]	469	37.7	37.7	19.4	5.2	61.4	25.4	14.2	1.805	0.20
Ukrainians of Kiev region[c]	170	34.1	41.8	17.1	7.0	65.1	22.6	12.3	0.401	0.50
Ukrainians of Cherkassk region (Uman)[d]	233	32.6	36.9	21.0	9.5	57.1	26.3	16.1	0.160	0.70
Ukrainians of Cherkassk region (Zvenigorod district)[d]	115	34.8	46.1	13.0	6.1	59.0	30.9	10.2	0.010	0.90
Polesie Ukrainians of Roven region (Sarny)[e]	172	37.8	29.1	27.3	5.8	61.5	20.3	19.2	0.530	0.50
Ukrainians of Chernigov region (Tschors district)[f]	149	38.2	28.9	24.2	8.7	61.8	20.1	17.2	0.128	0.70
Ukrainians of Chernigov and Zhitomir regions (Polesie)[g]	84	23.8	42.8	21.4	12.0	48.7	33.6	18.4	0.002	0.80
Steppe Ukrainians of Kherson region[h]	35	40.0	34.3	20.0	5.7	63.0	22.8	14.1	0.023	0.80

Table 1 (*continued*).

Zone, Ethnic group, territory	Number investigated	Frequency of phenotypes (percentages)				Frequency of genes (percentages)			χ^2	*P*
		O(I)	A(II)	B(III)	AB(IV)	r	p	q		
Ukrainians of Odessa region (Kothovsk district)[i]	122	27.8	41.0	24.6	7.4	52.7	30.2	19.7	0.328	0.20
Ukrainians of Kherson, Odessa, Nikolaev, and Zaporozhie regions[a]	62	35.5	35.5	24.2	4.8	59.0	25.3	18.3	0.627	0.50
Russians of Odessa region[j]	116	46.9	29.2	15.9	8.0	68.5	18.7	10.7	0.344	0.50
Bulgarians of Odessa region[j]	150	36.0	43.3	15.4	5.3	60.0	29.1	11.7	0.564	0.50
Moldavians of Odessa region[i]	120	35.0	44.2	15.0	5.8	59.2	29.8	11.5	0.120	0.70
Donetsk upland Ukrainians of Donetsk region (Amvrosiev district)[b]	300	31.0	38.0	23.7	7.3	55.7	27.4	18.3	1.875	0.20
Ukrainians of Voroshilovgrad region[k]	227	44.9	30.0	23.4	5.7	69.9	20.4	9.6	0.440	0.50
Mixed population (Russians and Ukrainians) of Voroshilovgrad region[k]	163	42.5	24.5	20.8	12.3	67.5	17.4	15.8	12.638	0.01
Crimea Ukrainians and Russians of the town of Simferopol (Crimean region)[l]	30	38.0	30.0	24.0	8.0	61.7	21.0	17.1	1.823	0.20
Mixed population (Ukrainians, Russians, and others) of Crimean region[m]	912	35.9	36.8	20.1	7.2	63.1	21.1	15.6	0.470	0.50
Carpathia Ukrainians of Lvov region (Skolev district)[e]	162	28.4	50.6	13.0	8.0	53.3	35.6	11.0	0.010	0.80
Ukrainians of Transcarpathian region (Irshav district)[b]	200	31.0	40.5	17.0	11.5	55.7	28.9	13.6	1.906	0.20
Uzhgorod[c]	30									
Suburbs of Uzhgorod[n]	200	33.5	38.0	18.0	10.5	58.8	27.1	14.0	1.031	0.30
Mukachev district[n]	200	35.5	41.5	18.0	5.0	59.4	27.8	13.4	1.688	0.20

Table 2. Distribution of phenotypes and genes of the MN blood groups (see *Key*, page 109)

Zone, Ethnic group territory	Number investigated	Phenotypes (percentages)			Genes (percentages)		χ^2	P
		M	MN	N	m	n		
Forest-steppe Ukrainians of Kiev region (Belotserkov district)[a]	261	39.08	39.85	21.07	59.00	41.00	7.86	0.01
Ukrainians of Kiev region[c]	170	40.00	44.70	15.30	62.35	37.65	0.26	0.50
Ukrainians of Cherkassk region (Uman)[a]	98	43.88	37.75	18.37	61.75	38.25	2.91	0.10
Ukrainians of Cherkassk region (Zvenigorod district)[a]	115	43.48	33.91	22.61	60.43	39.57	9.96	0.01
Polesie Ukrainians of Chernigov region (Tshors district)[f]	94	35.11	47.87	17.02	59.05	40.95	0.01	0.90
Ukrainians of Chernigov and Zhitomir regions (Polesie)[o]	41	17.00	67.00	60.00	50.00	50.00	3.80	0.05
Steppe Ukrainians of Odessa region (Kotovsk district)[i]	126	41.27	42.06	16.67	62.30	37.70	3.51	0.05
Ukrainians and Russians of Kherson region[p]	48	50.00	35.50	14.50	67.75	32.25	1.60	0.20
Donetsk upland Ukrainians and Russians of Voroshilovgrad region[h]	47	38.30	53.20	8.50	64.90	35.10	0.11	0.70
Crimea Ukrainians and Russians of the town of Simferopol (Crimean region)[p]	50	36.00	48.00	16.00	60.00	40.00	0.00	
Carpathia Ukrainians of the town of Uzhgorod (Transcarpathian region)[h]	30	40.00	43.30	16.70	61.60	38.40	0.21	0.50

Table 3. Distribution of the $Gm^{(1)}$ factor (see *Key*, page 109)

Zone	Ethnic group, territory	Number investigated	$Gm^{(1)}$ (percentages)	$Gm^{(-1)}$ (percentages)
Forest–steppe	Ukrainians of the Cherkassk region[c]	80	36.2	63.8
Polesie	Ukrainians of the Chernigov region[o]	52	38.6	61.4
Steppe	Population (Ukrainians and Russians) of the Kherson region[k]	50	34.0	66.0
Donetsk upland	Ukrainians of the Voroshilovgrad region[o]	117	37.8	62.2
	Russians of the Voroshilovgrad region[o]	74	43.2	56.8
Crimea	Population (Ukrainians, Russians, etc.) of Simferopol (Crimean region)[q]	50	46.0	54.0
Carpathia	Population of Uzhgorod (Transcarpathian region)[c]	113	49.5	50.5

Table 4. Distribution of the Hp factor (see *Key*, page 109)

Zone	Ethnic group, territory		Number investigated	Hp 1-1 no.	%	Hp 2-1 no.	%	Hp 2-2 no.	%	Frequency of gene Hp 2	Frequency of gene Hp 2	χ^2	P
Forest–steppe	Ukrainians of Kiev and of Kiev and Chernigov regions[c]	observed	639	141.0	22.1	320.0	50.1	178.0	27.8	0.471	0.529	0.040	0.80
		expected		141.7		316.6		178.8					
	Russians of Cherkassk region[c]	observed	92	19.0	20.7	50.0	54.3	23.0	25.0	0.478	0.522	0.690	0.50
		expected		20.9		45.9		25.1					
Polesie	Ukrainians of Chernigov region[h]	observed	75	18.0	24.0	35.0	46.6	22.0	29.4	0.473	0.527	0.300	0.70
		expected		16.7		37.3		20.8					
Steppe	Ukrainians and Russians of Kherson region[r]	observed	50	11.0	22.0	26.0	52.0	13.0	26.0	0.480	0.520	0.078	0.80
		expected		11.5		24.9		13.5					
Donetsk upland	Ukrainians of Voroshilovgrad region[h]	observed	225	52.0	23.1	116.0	51.5	57.0	25.4	0.488	0.512	0.133	0.70
		expected		52.5		112.3		57.7					
	Russians of Voroshilovgrad region[h]	observed	136	29.0	21.3	69.0	50.7	38.0	28.0	0.467	0.533	0.036	0.80
		expected		29.6		67.7		37.6					
Crimea	Ukrainians and Russians of Simferopol (Crimean region)[r]	observed	50	13.0	26.0	21.0	42.0	16.0	32.0	0.470	0.530	1.170	0.30
		expected		11.0		24.6		14.0					
Carpathia	Population of Uzhgorod (Transcarpathian region)[c]	observed	60	16.0	26.6	26.0	43.4	18.0	30.0	0.483	0.517	1.060	0.30
		expected		13.9		29.9		16.0					

Table 5. Distribution of the Gc factor (see *Key*, page 109)

Zone	Ethnic group, territory		Number investigated	Gc1-1 no.	%	Gc2-1 no.	%	Gc2-2 no.	%	Gc1	Gc2	χ^2	*P*
Forest–steppe	Ukrainians of Kiev and of Kiev and Cherkassk regions[c]	observed	567	277	48.8	234.0	41.2	56.0	10.0	0.694	0.306	0.360	0.50
		expected		273		240.7		53.0					
	Russians of Kiev and of Kiev and Cherkassk regions[c]	observed	151	83.0	56.2	54.0	35.8	12.0	8.0	0.741	0.259	0.660	0.50
		expected		82.7		57.9		9.9					
Polesie	Ukrainians of Chernigov region[h]	observed	51	26.0	50.9	21.0	41.1	4.0	8.0	0.714	0.286	0.0124	0.90
		expected		25.9		20.5		4.2					
Steppe	Ukrainians and Russians of Kherson region[r]	observed	50	26.0	52.0	19.0	38.0	5.0	10.0	0.710	0.290	0.282	0.50
		expected		25.2		20.5		4.2					
Donetsk upland	Ukrainians of Voroshilovgrad region[h]	observed	130	71.0	54.6	49.0	37.7	10.0	7.7	0.734	0.266	0.204	0.50
		expected		72.0		49.2		8.7					
	Russians of Voroshilovgrad region[h]	observed	118	64.0	54.2	47.0	39.8	7.0	6.0	0.741	0.259	0.127	0.70
		expected		64.7		45.5		7.8					
Crimea	Ukrainians and Russians of Simferopol (Crimean region)[r]	observed	50	28.0	56.0	18.0	36.0	4.0	8.0	0.740	0.260	0.228	0.70
		expected		27.3		19.2		3.3					
Carpathia	Population of Uzhgorod (Transcarpathian region)[c]	observed	60	33.0	55.0	21.0	35.0	6.0	10.0	0.725	0.275	0.860	0.30
		expected		31.5		23.9		4.5					

Table 6. Distribution of phenotypes of the Rh-Hr system (see *Key*, page 109)

Zone	Ethnic group, territory	Number investigated	Rh-Hr phenotypes (percentages)							
			CCee	CcDee	CcDEe	ccDEe	CCDEe	ccDee	ccDEE	ccdde
Forest–steppe and Polesie	Ukrainians of the Chernigov region[h]	43	23.3	48.8	9.30	7.0	2.30	2.30	0.00	7.0
Steppe	Ukrainians and Russians of the Kherson region[p]	48	16.6	35.4	8.30	18.7	2.08	0.00	2.08	12.5
Donetsk upland	Ukrainians and Russians of the Voroshilovgrad region[k]	47	23.4	25.5	6.40	8.5	10.60	2.10	0.00	23.4
Crimea	Ukrainians and Russians of Simferopol (Crimean region)[p]	50	30.0	20.0	12.00	10.0	4.00	0.00	2.00	22.0
Total		188	23.4	32.9	9.04	11.1	4.70	1.06	1.06	16.4

Table 7. Distribution of the D, C, E, c, and e factors

Factor	Occurrence (percentage)
D	83.60
C	70.40
E	25.90
c	71.56
e	99.66

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Odontological Characteristics of Caucasian Ethnic Groups

R. S. KOCHIYEV

The program for this survey was suggested and worked out by A. A. Zubov. The techniques of material collection under field conditions and the method of tooth indentation using dental wax, as well as the methods of determining odontological indices both visually, with the help of a dentist's mirror, and on dents corresponds to the program and methods set forth by Zubov (1968).

The survey was conducted in secondary schools and boarding schools; boys and girls aged from twelve to sixteen representing local aboriginal population were covered. All the indices studied exhibit no marked sex differences either in their structure or in the degree of distinctness, which is why we have not classified the data by sex. All in all, 3,168 subjects were covered, an average of 100 subjects or more per group, as detailed in Table 1.

1. SHOVEL-SHAPED INCISORS

By the occurrence of shovel-shaped medial incisors (points 2 and 3 — total) the Nogays stand out from the other Caucasian peoples with 37 percent. In the other groups the occurrence of shovel-shaped incisors ranges from 0 to 8 percent, and even here indices above 5 percent were found only in three groups. No regularity of distribution of this index in accordance with ethnic neighborhood or geographic relief has been determined. In half-breed and Afro-Europoid populations the shovel shape is generally more pronounced on the lateral incisors. This feature is found in the Caucasian peoples: 43 percent in the Nogay group and from 0 to 13.44 percent in the other groups. No regularity of distribution of this index has been determined either.

Table 1. The number of subjects in Caucasian ethnic groups

Ethnic groups and locality	*n*	♂	♀
1. Azerbaijanis: Baku	107	54	53
2. Azerbaijanis: Shemakha	105	52	53
3. Azerbaijanis: Agdam	101	51	50
4. Armenians: Goris	107	57	50
5. Armenians: Stepanakert (Karabakh area)	110	55	55
6. Armenians: village of Odzun (Allaverdy district)	106	54	52
7. Adjars: Batumi	100	50	50
8. Imeretins: Samtredia	101	50	51
9. Mengrels: Zugdidi	107	52	55
10. Abkhazians: village of Bzyb	100	50	50
11. Cartalinians: Gori	102	52	50
12. Cahetians: Telavi	110	59	51
13. Khevsoors: village of Barisakho	102	53	49
14. Rachins: Oni	85	43	42
15. Jews: Tskhinvali and Oni	83	43	40
16. Ossets: South Ossetia, village of Java	109	55	54
17. Ossets and Digorians: village of Chikola	107	56	51
18. Ossets and Ironians: village of Olghinskoye	102	53	49
19. Adyghes: Maikop	104	52	52
20. Kabardinians: village of Chegem	103	51	52
21. Circassians: village of Koshkhabl	71	52	19
22. Balkars: village of Sovietskoye	104	52	52
23. Karachays: Karachaiyevsk	107	54	53
24. Ingushes: Nazran	104	52	52
25. Chechens: village of Vedeno	106	56	50
26. Nogays: village of Karanogai	106	53	53
27. Kumyks: Hassavyurt	101	50	51
28. Laks: village of Kumukh	99	58	41
29. Avars: village of Gunib	112	61	51
30. Darghins: village of Hadjalmahi	102	52	50
31. Lezghins: village of Kasumkent	105	53	52

Note: Names of localities given without definition stand for towns.

2. CARABELLI's CUSP

In the territory of the Caucasus, in twenty-seven of the thirty-one groups the range of variation of the total frequency of Carabelli's cusp (points 2 to 5) is 15 to 30 percent, with groups having the maximum and minimum index frequencies living in adjacent areas on both slopes of the main Caucasian Ridge. Thus, in the Armenians of the Negorny Karabakh area (the town of Stepanakert), the Carabelli's cusp frequency of occurrence is as low as 10.91 percent, while in other groups of this area — Abkhazians, Imeretins and Jews — this index is maximum for the whole of the Caucasus: respectively 42.00, 41.00, and 40.92 percent.

3. DEFLECTING WRINKLE OF THE METACONID

The frequency of occurrence of the deflecting wrinkle of the metaconid in the various ethnic groups of the Caucasus was found to range from 3 to 16 percent. The Caucasian population is extremely homogeneous in terms of this archaic index, and among the Nogays this index is not the highest: in four groups dispersed about the Caucasus the frequency of occurrence of the deflecting wrinkle of the metaconid is higher — the Azerbaijanis of Agdam, the Armenians of Karabakh, the Mengrels, and the Adyghes.

4. DISTAL TRIGONID CREST

Among the ethnic groups of the Caucasus the highest frequency of occurrence of the distal trigonid crest was registered, as expected, among the Nogays, with 15.0 percent. However, high values of this index were found in the Jews and in the Rachins: 12.0 and 12.05 percent, respectively.

There is not a single group in the Caucasus in which the distal trigonid crest is totally absent; in almost half the groups studied this index was in excess of 5 percent. Possibly, this is a reflection of the anterior-Asian origin of the Caucasians (except the Nogays) and their great proximity to the pole of "Oriental" indices which, according to Zubov (1968), must lie in Southeast Asia, somewhere close to the border between Asia and Europe. Unfortunately, no odontological data are available for the territories bordering on the Caucasus — Turkey, Iran, Afghanistan, and so forth — which could considerably enrich our knowledge of the origin of the Caucasian peoples.

5. TUBERCULUM ACCESSORIUM MEDIALE INTERNUM

A study of this index according to the method proposed by Zubov (1968) revealed the highest frequency of occurrence of the tuberculum accessorium mediale internum among the Nogays. The relatively small group of Circassians also had a rather high value of this index: 10.0 percent; but the group size does not permit considering it absolutely representative. In all the other Caucasian groups the frequency of occurrence of the tuberculum accessorium mediale internum lies within 0 to 5 percent.

6. PATTERN OF THE MOLAR CROWN

The pattern of the upper molar crown was determined according to Dahlberg (1971), i.e. by the degree of hypoconus reduction.

The range of variation (forms 3 and 3+ — total) of hypoconus reduction on M^2 among the Caucasian peoples is rather considerable for such a small area: 43 to 77 percent; there is a marked trend for the highest values of this index to occur among isolated groups. Thus, the highest degree of reduction in the Caucasus is found in the mountainous Dagestan groups: Avars and Darghins, followed by the Jews.

The least hypoconus reduction on the second upper molar is found in the peoples of the northern Caucasus, the Deghestan plains, Armenia, and Azerbaijan. Here this index varies between 50 and 60 percent. In the Black Sea coast groups this index varies from 61 to 68 percent. In the highland Georgian groups the range of variation of the index is somewhat higher.

7. PATTERN OF THE FIRST LOWER MOLAR CROWN

A high frequency of occurrence of the hexacusp form of the first lower molar was noted among the Ossets and Digorians: 6.93 percent; and Yuzhans: 4.20 percent. Then follow the Khevsoors: 2.94 percent; the Rachins: 2.40 percent; and the Ingushes: 1.94 percent. In all other Caucasian groups the hexacusp forms on the first lower molar are either totally lacking (sixteen groups) or occur very rarely — up to 1 percent.

The highest frequency of occurrence of the tetracusp form on M_1 was registered in the Daghestan mountaineer groups; the Darghins: 26.48 percent, and the Laks: 24.24 percent. The lowest values of the index were found in Nogays, Armenians of the town of Gori, Khevsoors, and Adyghes: 4 to 5 percent. In all the other groups of the Caucasus this index varies from 7 to 20 percent, exhibiting in its distribution no regular correlation either with the area or with the ethnos, and staying within the range typical of the Europoid race.

8. PATTERN OF THE SECOND LOWER MOLAR CROWN

The hexacusp share of the second lower molar — a feature characteristic of the equatorial and Mongoloid racial trunks — was found in only seven cases among thirty ethnic groups of the Caucasus; among 100 Nogays this index was found twice.

The pentacusp shape of M_2 is rather high among the Nogays: 18.0 percent; the other Caucasians, except two Azerbaijani groups, have a reduced frequency of occurrence of this index, from 4 to 10 percent.

The tetracusp shape of the second lower molar was, as expected, the least frequent among the Nogays: 80.0 percent, while for all the other

ethnic groups of the Caucasus this index occurred in about 90 percent of cases and more.

The tricusp shape of the second lower molar was found only in eight cases.

The frequency of occurrence of the Y-pattern on the first molar among the Caucasian ethnic groups is often close to the world minimum (i.e. 60 percent). The same can be said of the second lower molar: the frequency of occurrence of the Y-pattern ranges from 0 to 10 percent in the Transcaucasus; it is somewhat higher in the northern Caucasus, particularly among the Ossets and Digorians (23.23 percent) and in the mountaineer Daghestan groups (15–19 percent).

9. REDUCTION OF THE UPPER LATERAL INCISOR

Reduction of the lateral incisor is a frequent phenomenon in the territory of the Caucasus: from among the thirty-one groups only the Jews and the Ossets and Digorians fail to register a pronounced two- and three-point reduction. Yet, one-point forms of reduction occur in more than 26 percent of the Jews; for the Digorians this figure is even higher: 32.70 percent.

The highest percentage of pronounced reduction was found in the Azerbaijanis: 9.00 percent; then follow the Shemakha Azerbaijanis: 7.60 percent, and all three Armenian groups: from 4.72 to 7.45 percent.

The lowest concentration of this index was found in the West Georgian populations living close to the Black Sea: Abkhazians, Adjars, Mengrels, and Imeretins. In these groups the frequency of occurrence of reduction is somewhere around 1 or 2 percent. This index is distributed very uniformly in the ethnic groups of the northern Caucasus and Daghestan plains, where it was found in 3 to 4 percent of cases. On the other hand, its distribution is extremely nonuniform in three mountaineer Daghestan groups living in the immediate vicinity of one another; the Avars: 9.00 percent; the Laks (close neighbors of the Avars): only 1.0 percent; and the Darghins: 3.00 percent.

10. PROTOSTYLID

The protostylid (points 2 to 5 — total) is practically nonexistent among the peoples of the Caucasus; it was found only in seven cases. On the other hand, the protostylid depression, an index generally ignored by odontologists, was found by us in many cases: its frequency among the Nogays, for instance, was 61.60 percent. It seems that not only a cusp, but in fact any other formation in the protostylid zone, such as a depression, is

associated to a certain extent with the Mongoloid race or with the complex of Oriental indices. The Ingushes, the Chechens, and the Kumyks had the protostylid depression in 40 percent of cases; in five Daghestan groups it was present in 28.0 to 37 percent of cases. In the Transcaucasus the depression occurs somewhat less frequently, but there are exceptions to this rule even here: the Khevsoors, with 33.15 percent. This index is the lowest for the Jews — as low as 3.70 percent.

11. HYPODONTIA

Hypodontia of the lower medial incisor was totally absent in all the subjects of our study. Hypodontia of the second upper premolar was found only in several groups of the northern Caucasus and Daghestan, where only among the Nogays and the Avars does this index reach 2 percent, while in the remaining nine groups only one case per group was registered, i.e. one percent or less.

Hypodontia of the upper medial incisor is somewhat more frequent. Yet this frequency, too, is insignificant: from 0 to 4.68 percent. Only the Avars, with their 6 percent frequency, stand apart from all the rest of the Caucasians. A relatively high frequency was noted for the Ossets: an average of 3.75 percent for each of three Ossetic groups. On the whole, hypodontia of the lateral upper incisor is somewhat more frequent in the northern Caucasus as compared to the Armenians, Azerbaijanis, and Georgians.

BRIEF CONCLUSIONS

1. According to the odontological material, the population of the Caucasus, except the Nogays, unquestionably belongs to the western (Europoid) racial trunk. Moreover, the indices of reduction of the tooth system (reduction of the lateral incisor, the crown patterns of the second upper and the first and second lower molars), which at present serve as the principal criterion whereby the Europoid tooth complex is distinguished from the Afro-Negroid one within the western odontological trunk, among the Caucasian peoples are close to the world maximum; by some indices the Caucasian values exceed those of all other known populations of the world, which seems to be a characteristic feature of the southern branch of the Europoid race.

2. At the same time, by several indices of a high taxonomic value (reduced frequencies of Carabelli's cusp, higher frequencies of the distal trigonid crest and of the type-3 shape of the front depression on the first lower molar, etc.), the frequencies of the odontological indices in the

Caucasus slightly but distinctly go beyond the range of frequencies characteristic of the Europoid odontological complex and shift toward the frequencies typical of the Oriental odontological complex.

3. These traces of the Oriental odontological complex are observed over the entire territory of the Caucasus, which in our opinion suggests a common primordial layer containing features of Oriental origin from which sprang all the Caucasian peoples. This is not to rule out the possibility that there was some later-time influx of Oriental (in this case definitely Mongoloid) indices, particularly to the northern Caucasus, for in the northern Caucasus we observe an increase (compared to the Transcaucasus) in the frequencies of shovel-shaped medial and lateral incisors, distal trigonid crest, protoconulus, tuberculum accessorium mediale internum, and type-3 shape of the front depression on the first lower molar, as well as a reduction in the Carabelli's cusp frequency, although even here these indices fail to reach the average characteristic of the Oriental complex.

4. The above-described interpopulation differences in the Caucasus are very insignificant if compared to world intergroup differences. The vast majority of the Caucasian groups are found to be extremely close to one another, forming a homogeneous odontological type which could be labeled Caucasian. This type is characterized by a high (close to the world maximum) level of reduction of the tooth system in combination with more easternlike frequencies of indices than is typical of the North Europoid odontological complex.

5. Some groups, however, deviate from the average Caucasian type indices rather considerably (on the scale of the Caucasus). In some cases these deviations stem from the alien origin of a given population; in other cases the reasons for them should be sought in the index frequency changes due to the genetico-automatic processes in isolated populations.

6. The alien origin of the Nogays has been unambiguously proved by odontological analysis, which has shown them to have pronounced eastern or Mongoloid traits.

7. Changes in the concentration of a number of indices due to isolation have been found primarily in the highland Daghestan groups — the Laks, the Avars, and the Darghins — and to a somewhat smaller extent in the Checkens and the Ingushes. Features of isolation have also been found in the Khevsoors and Karabakh Armenians, who, in spite of their exogamous marriage customs, are separated from their nearest neighbors by religious and linguistic (Armenians), cultural (Khevsoors), and, above all, geographic barriers.

8. The somewhat peculiar tooth complex of the Jews found by odontological analysis seems to be explained by the Jews' alien origin and also by the genetico-automatic processes which invariably occur in isolated groups due to endogamy and religious and cultural isolation.

9. Odontological analysis has revealed an alien component in the tooth complex of the Ossets which, beyond any doubt, cannot be ascribed to isolation processes. Judging by the results of linguistic analysis and on the basis of historical data, the alien component in the Ossets is apparently of Alan origin.

10. An attempt to classify the Caucasian odontological type into subtypes and to correlate it with the somatic types and variants found in the Caucasus has failed. Our analysis of rank correlations has given no results either: for practical purposes, no coefficients of intergroup rank correlation are found to exist between all pairs of odontological indices; those between the major odontological indices and the somatic indices of the Caucasians have proved too low to outline any definite complexes. Even the Caucasian type, the most distinct in the Caucasus, does not differ by odontological characteristics from the other Caucasian groups, which obviously points to its autochtonous origin.

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The Anthropology of a Capital City and Considerations on Urbanization

G. OLIVIER and F. BRESSAC

In any advanced society, urbanization is one of the most important changes. It gives rise to a host of implications, some of them — biological ones — being the research field of physicians and anthropologists. For a long time we have known that certain morphological differences exist between town and country dwellers. Here we shall deal first with the arguments proposed to explain these differences, contrary to the current method of leaving them for the final discussion. In any capital city, however, new problems keep cropping up, and in order to meet them one must take into account, as one proceeds, certain generally accepted factors:

1. The large gene pool of the big cities, the manifestations of which are greater variety and the heterosis effect (increase in stature) which arises from hexogamy (Hulse 1958; Sutter et al. 1958; Schreider 1968; Billy 1971), is important, as are decreases in endogamy and, as a result, in consanguinity, which diminish the "depressive" effect on the body format.

2. Aubenque and Desabie (1957) stress the difference in professional distribution between town and country. Workers in agriculture present distinct characteristics: they are shorter and more thickset, with round heads (Trémolières and Boulanger 1950; Chamla et al. 1959; Schreider 1964, 1969; Ignazi 1971; Olivier 1970b).

3. Living conditions, hygienics, food, climate, and pollution differ between town and country; their effects, however, have never been properly separated from the preceding factors. "The way of life" has become a vague expression which hides our ignorance of the nature of the

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factors which bring about the modifications of people living in towns: diet, housing, noise, mental stress, lack of peace and quiet, etc.

4. Finally, thanks to zoology, we know of "group pressure" (Grassé 1958) which reflects itself on reproduction and development. It has been demonstrated that in man urban life is accompanied by faster growth and earlier puberty, but it is not known whether this holds good for the populations of cities at all levels (the question of students is still under discussion).

Recent urbanization has acquired a further characteristic common to all metropolises, that of immigration from the countryside, less important towns, or abroad. The reasons for this are fairly well known: social advancement (appointment in a metropolis), looking for a job with higher wages, but mainly because work is unavailable in the home area (this is Grassé's "*appétition sociale*," 1958). In France we know *where-from* people leave (Bretagne, Massif Central) and *whereto* they are bound (Lyon, Marseille, Paris). The majority of the inhabitants of the large cities are emigrants of this kind, presumably unlike the people who lived in smaller towns in the past, when the recruitment was from the same region or rural areas. To add to an already complex problem, the emigrants differ from their groups of origin (Boas 1912; Hulse 1958; Schreider 1968); and certain individuals, though we cannot say why, come physically to resemble the population they are going to join (Olivier 1964, 1965, 1971). It would be of great interest to conduct a further study on emigrants from abroad, particularly from North Africa; this, however, would require extra samples for comparison.

To answer these questions one basic piece of information is missing: what is the anthropological structure of the inhabitants of very large cities? In fact, to make a study of immigrants we should draw a comparison between them and the sedentary rural population as well as with the populations of the provincial towns and the capitals. Do the latter exist at all? Maybe they do, although in very small numbers, and quite an effort would be required to get together a sample of citizens whose great-grandparents were all born within a capital city. However, we shall see that the "relatively sedentary" populations display some characteristics of their own. By "relatively sedentary" we mean inhabitants of large cities whose parents were born there, and these will be the object of the present study. Not only will this give us an opportunity to compare them with immigrants, they also have the advantage of being of exactly similar urban origin, therefore permitting a study of the different variation factors.

DOCUMENTATION

We have made use of part of the important data provided by Chabeuf (1973), adding the "Register Office" details concerning the civil status of each subject; Chabeuf's work was on regional anthropology and a continuation of a study made by one of us (Olivier 1970a). We have used everything which refers to the Paris region and will attempt to report on and then interpret the characteristics possessed by people living in this capital.

Although all the necessary information has been provided by Chabeuf, we should recall that his study does not include adults, only young people between eighteen and nineteen years of age, who are not fully grown; to make valid comparisons between our subjects we must assume that the growth rate is the same in all groups (not a matter of certainty, however). We have made a single group of Parisians and those living in the suburbs, while all comparative data relate to the former Département de la Seine (No. 75); this is perfectly normal, since many Parisians live in the suburbs where housing is easier to find; also, not all suburban communities are strictly "dormitory" areas. In any case the kind of life that is led there is similar to that of the actual Parisians, the only detail of difference being the time they spend commuting. The restriction of the capital to the old Département de la Seine is valid in the case of young people born twenty years ago: nowadays the margins of the Parisian agglomeration have expanded outwards. To reduce the possibility of error we have only taken into consideration the data from a single observer; according to Chabeuf some subjects from Seine-et-Oise were combined with those from Seine-et-Marne to make up a comparative regional sample. All the subjects were examined at the Vincennes Selection Center (near Paris) in 1968; the only choice exercised was in using only individuals born in the same département as their parents.

To both these samples, presented in a different manner from Chabeuf's study, we must add two more series gathered from Parisians, which will be referred to from time to time: one group is of eighty individuals who were examined in 1970 by another worker (this differs from the previous group, the individuals having narrower noses and other distinctive features); the other consists in a test carried out in 1973 on the stature of 640 nineteen-year-old Parisians, 133 of whom were "native" Parisians as defined above. These are in all three different samples of Parisians (one of which is principal) and one regional sample for comparison.

There are a couple of reservations, however, one concerning the exiguity of the series, which means that caution will have to be exerted in interpreting the statistical tests; the other concerns the lack of professional qualification of the subjects, due to their young age; in some cases we will need to refer to the father's profession to establish their social

background, as Olivier has done (1970b); also, because of the extended schooling period, we have found it necessary to include in our definition of "student" not only higher education, but also technical and professional training (namely, *secondaire*), even when not of major importance; in brief: all subjects not involved in "active life" will be classed as students.

At our request, a study was made by Dr. Courgeau on all individuals who had passed through the Selection Center at the time of our examinations in 1968: it was found that the "native" Parisians were not as rare as we would imagine, as some 13 percent of people living in Paris in this age group fitted our sample definition; this confirms Pourcher's data (1964) on the Parisian population and seems to indicate some consistency in this "relative sedentariness".

PROBLEMS

Table 1 shows the measurement means and percentages of descriptive characteristics of both the Parisian samples and the comparative sample of the Département de Seine-et-Marne. It may be seen that the native Parisians are mesocephalic and of rather large proportions, complexion moderately fair, and tend to be of the slender type or leptosomatic, i.e. fairly long-limbed. They differ from their neighbors in several traits: they have longer heads and their slim builds means a reduction in weight and girth, though they are curiously similar in stature. As shown by the chi-square values, there are no statistical differences as concerns descriptive features; nevertheless it may be emphasized that compared to Seine-et-Marne subjects, there is a tendency in those born in Seine to have darker eyes and fairer hair[1] of more uniform type (usually wavy); the nose profile, on the other hand, is more varied and has a less marked intermediate (i.e. straight) shape; finally, facial hair (measured according to the Khérumian scale) not only is less prominent, but is so to an almost significant extent. These differences may of course seem fortuitous, although they are all confirmed, as far as measurements are concerned, by the second sample of Parisians (eighty subjects).

As easy as it is to assess differences, it is equally difficult to find an explanation for them. Before introducing the question of gene assortment and intermixing of people from all regions in the capital city, we must see to what extent and by which mechanism (selective or otherwise) such morphological changes have been promoted by the milieu, both geographic and human. Table 2 shows the differences we have been able to detect between Paris and neighboring regions based on the birthplace

[1] Contrary to the old claim that towns cause hair to darken.

of the subjects. The differences in professional occupations are the essential item; but this is not all and — "there's the rub!" — not all are known to us, since we are unable to discover what is meant by "way of life." The average Parisian temperature is underestimated for both winter and summer, because it does not take into account the "thermal islet" which is created by all large cities. We should ask ourselves anyway whether these factors contribute to the differences found in Table 1, even though we are unaware of the way they operate under morphology. We shall of course disregard minimal differences. We do not wish to suggest, for instance, that mesocephaly is more marked in Paris due to a lower altitude! Above all, the differences in the human setting may provide a solution to some of our problems.

The Question of Height

In principle one should disregard height, since it is the same in Paris and Seine-et-Marne. But there happens to be an anomaly here, town-dwellers being usually taller; if one examines the statistics published by Trémolières and Boulanger (1950) concerning all young people aged twenty born in 1928, one sees a height gradient running inverse to bodily size:

Birthplace	*n*	Height	Weight	Livi's ponderal index
Seine (Paris and suburbs)	16,575	169.7 cm	60.7 kg	23.16
Seine-et-Oise	7,834	169.2	61.7	23.315
Seine-et-Marne	2,376	168.6	61.0	23.34

This gradient is confirmed by Khérumian and Schreider (1963), once again among young individuals. As a matter of fact, the average height of 137 twenty-year-old subjects from the Seine was 172.5 cm in 1960 (Chamla, 1964). The height of our Parisians (171.9) is therefore too weak. They are young, of course (eighteen and a half), and one may suppose that they will have grown one centimeter by the time they are twenty. This is insufficient, however, since the ten-year height increase must also be accounted for. Actually, considering the invaluable data provided by Chamla (1964) on height evolution, it is seen not only that there is an increase in height from one decade to another, but also the rate of growth accelerates. At all events, the data provided by this worker can be split and roughly represented by two straight lines: the one sloping gently is prior to 1930. (The 1920 mean is lowered in this case, due to the privations caused by the First World War; the 1950 line has a somewhat steeper slope, according to the département in question; from 1930 on a

Table 1. A comparison of distinctive features between Parisians and inhabitants of neighboring areas

Measurable features	1. Paris (n=235) mean	σ	2. Seine-et-Marne, Marne (n=115) mean	σ	t test (1+2)	3. Paris (n=80)[c] mean	σ	t test (2+3)
Weight	63.77	7.60	66.54	8.43	2.98[b]	63.21	6.79	3.05[b]
Height	171.86	5.94	171.47	5.50	0.60	172.90	6.37	1.63
Sitting height	90.74	2.99	90.59	2.82	0.46	91.08	3.10	1.13
Biacromial breadth	39.04	1.66	39.38	1.95	1.61	39.12	1.83	0.95
Bicristal breadth	27.16	1.51	27.59	1.44	2.58[b]	27.17	1.41	2.03[a]
Circumference of thorax	90.18	5.57	91.45	5.63	1.98[a]	89.84	4.47	2.15[a]
Head length	194.2	6.79	192.8	6.22	1.98[a]	194.0	6.81	1.25
Head breadth	153.4	5.58	153.2	5.38	0.40	154.6	5.78	1.71
Face breadth	138.4	4.91	138.5	4.89	0.10	138.3	4.89	0.29
Face height	120.8	5.64	120.9	5.80	0.20	120.3	6.56	0.60
Nose height	53.7	3.61	53.15	3.41	1.36	53.2	3.92	0.09
Nose breadth	33.9	2.31	33.6	2.34	0.95	33.2	2.26	1.20
"General level" test	12.41	5.54	9.53	5.11	4.82[b]	14.28[d]	4.73	6.67[b]
Sitting height index	52.80	1.24	52.85	1.32	0.27	52.71	1.47	0.68
Biacromial breadth index	22.72	1.03	22.97	1.07	2.08[a]	22.64	1.02	2.18[a]
Bicristal breadth index	15.80	0.80	16.10	0.76	3.39[b]	15.73	0.79	3.27[b]
Thorax perimeter index	52.50	3.46	53.42	3.43	2.34[a]	52.04	3.04	2.96[b]
Livi's ponderal index	23.23	0.88	23.61	0.93	3.63[b]	23.03	0.86	4.48[b]
Cephalic index	79.00	3.87	79.40	3.30	1.11	79.72	3.57	0.63
Facial index	87.28	4.55	87.29	4.64	0.02	87.24	5.47	0.07
Nasal index	63.13	5.85	63.22	6.10	0.13	62.85	6.54	0.40
Digital delta (n=321)	12.73	3.46	12.69	3.44	0.10[e]			
Palmar dermatoglyphic index	8.78	2.13	8.68	2.22	0.61[e]			

Table 1 (*continued*).

Descriptive characteristics		Percentage	Percentage	Chi-square	Degrees of freedom
Thenar patterns[c]		12.55[e]	13.5	0.13	1
Hypothenar patterns		36.2[e]	38.3	0.30	1
Type of hair:	straight	42.6	46.8		
	wavy	38.1	26.6	4.87	2
	curly, kinky	19.3	26.6		
Color of hair:	fair	10.6	6.1		
	light brown	18.3	18.3	3.80	3
	dark brown	57.5	55.6		
	very dark	13.6	20.0		
Color of eyes:	light	37.9	49.5	4.54	2
	mixed	13.6	9.6		
	dark	48.5	40.9		
Nose profile:	concave (upturned)	13.6	18.3		
	straight	59.9	60.9	5.80	3
	curved (sinuous)	19.6	15.6		
	convex (aquiline)	11.9	5.2		
Facial Hair:	slight (0+1)	43.0	27.8		
	moderate (2)	30.6	39.1	7.58	3
	medium heavy (3)	14.5	17.4		
	heavy (4+5)	11.9	15.7		

[a] Significant at 5 percent level.
[b] Significant at 1 percent level.
[c] Different examiner.
[d] Series with a larger proportion of students.
[e] Regrouping of samples 1 and 3 (same observer).

Table 2. Geographic and sociodemographic data of samples (calculated on the basis of subject's birthplace)

	Seine (n = 235)	Seine-et-Marne (n = 115)
Average rainfall	550 mm	624 mm
Average summer temperature	18.5°	18.5°
Average winter temperature	2.5°	3°
Percentage of localities above 100 m	0	12.2
Percentage of localities with fewer than 500 inhabitants	0	13.9
Percentage of students in sample	35.5	24.4
Percentage of fathers in non-agricultural work	55.9	56.0
Percentage of fathers in agricultural work	0.4	13.05
Average family size	3.3	3.4
Average position in the family	2.0	2.2
Percentage of large families (four children or more)	36.2	37.4

definitely steeper line may be drawn.) Splitting the data into two straight lines is artificial: it means that the exponential curve is avoided precisely where a logistical approach is preferable, if not more appropriate. Futhermore, this approach confirms the work by Billy (1968), who envisages a break in the evolutionary rhythms between 1920 and 1925, as if one could date some particular phenomenon from that time. Partly, at any rate, this could have been an advance in puberty, which meant that full growth was attained earlier. Logarithmic coordinates would make Table 1 more demonstrative; unfortunately we do not know the origin of the phenomenon of height increase (this matter had already been investigated by Boudin in 1865!). Chamla's data show that this is a general phenomenon in France, but particularly marked in Paris, the difference in acceleration between Seine and Seine-et-Marne having come to light only recently.

In any case, by extending the second straight line, one would expect a height of around 174 cm in a twenty-year-old Parisian youth in 1970. As our figure is weaker than this, we must look and see whether the height increase has fallen off or whether some parasitic phenomenon has managed to infiltrate our data. The latter is evident; the nature of our sampling itself lowers the expected mean: we have in fact only taken Parisians born of Parisian parents, i.e. the sedentary aliquot (roughly 13 percent) of the population.

Now, it is readily shown that the classical reducing effect of relative sedentariness (and resulting endogamy) comes into play even in a large city. The third sample of Parisians yielded experimental evidence of it. In January 1973 one of us took the average height of 640 young Parisians aged nineteen: this was 173.5 cm, and one may suppose that it will be equal

to or more than 174 cm by the time these persons have reached twenty years of age. We expected this result, by extension of the second straight line in Figure 1. Among these individuals some were undoubtedly born in Paris; some are only inhabitants; 133 of them correspond to our definition of native Parisians and their height is 172.6 cm, slightly taller than the

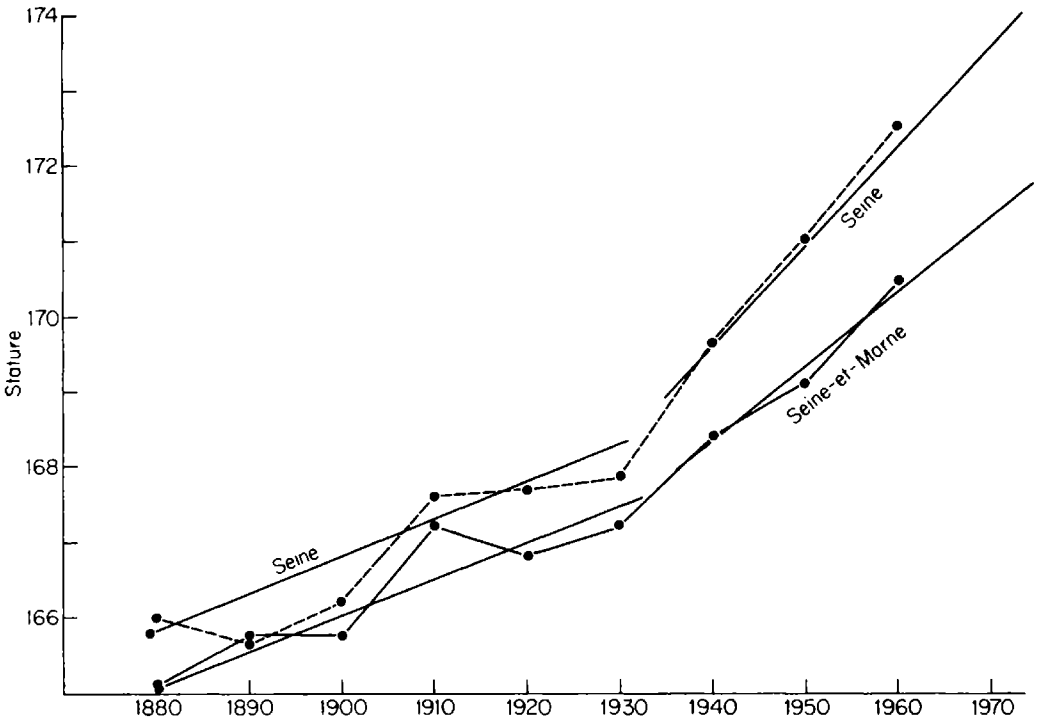

Figure 1. Evolution of stature at twenty years of age (from Chamla 1964)

subjects in the test sample of 1969 (the object of this study), while their bodily size was the same. The remaining number of youthful individuals measured 173.8 cm, that is, one cm more than the sedentary ones. Those with parents born in other départements attained 174.1 cm. It is a well-known fact that the greater the gene mixture the greater the stature. It is of course surprising to come across instances of endogamy or exogamy in a capital city. Schreider (1968) sees this greater stature as a manifestation of heterosis. There are two complementary observations to this: on the one hand this phenomenon does not seem to last longer than a generation or two, as frequently happens elsewhere; and on the other, our native Parisians who are smaller must necessarily have had ancestors who migrated from other places, who presented at some generation or other a heterosis process which has not lasted. Furthermore, assortment is accompanied by superior ability in mental I.Q. tests, as we shall see.

Let us return to the main purpose of our study, namely, urban sedentariness, to point out two other factors which are likely to be involved in the

smaller stature of native Parisians. First, consanguinity is more marked in Paris than in the surrounding areas (Sutter and Goux 1964) and may play some role in the sedentary aliquot of the population. In addition, this consanguinity seems to have decreased slightly more slowly in Paris than in Seine-et-Oise and Seine-et-Marne; the rates of consanguinity should have equalized by about 1970. The more rapid decline in consanguinity might be correlated to the more marked increase in height. In other words, it may not be the rate of consanguinity so much (as Schreider indicated in 1968) as its evolution, which probably influences growth acceleration. The other factor is the rapid reduction in the infant mortality rate prior to one year of age, though here, according to the French Statistical Handbook, the percentage is a little higher in Seine-et-Marne than in Seine, or was so at least until recently. Thus, the usually smaller stature found in Seine-et-Marne and the slower growth here may also be explained by the selective effect of infant mortality. Both coincidences, though unproven, are worth mentioning.

Slender Type (Leptosomatic)

Let us try to find an explanation for the bodily size of native Parisians. Their morphological type can be related to family composition, agricultural work, or the student condition.

1. Subjects from large families show a slight reduction in size (Boas 1912; Trémolières and Boulanger 1950; Olivier, 1970c). They also show a tendency toward the pycnic or broad type, partly due, however, to biometric factors; on average, the shorter the individual, the stockier. As far as we are concerned, this is an irrelevant factor, since in the sample for comparison both the number of children and the stature are the same. Furthermore, a curious fact is found in our Parisian sample: the subjects who belong to large families are slightly bigger and consequently more leptosomatic (judging by the lowef ponderal index). Anthropometric relationships according to the family structure are not therefore always the same. In Trémolière's table (Trémolière and Boulanger 1950:132), bodily size does not change according to the position in the family, as can be seen by estimating the ponderal index in, for example, the Département de la Seine, but a distinction must be made between position in the family and the number of its members.

A further element comes to light in Table 3: longest and narrowest heads in big families, which happens to distinguish Parisians as compared to the test sample of Seine-et-Marne, although there is not a larger number of bigger families in Paris. We should add that in this sample subjects from large families, as is usually the case, are a little less tall (also true for the second group of eighty Parisians). The head, being longer, is

Table 3. Comparison between small and large families in Paris

	94 subjects from families with 1 to 3 children		140 subjects from families with more than 4 children		
	mean	σ	mean	σ	t test
Height	170.97	5.93	172.48	5.91	1.91
Weight	63.68	8.66	63.45	7.17	0.21
Livi's ponderal index	23.32	0.881	23.03	0.819	2.54[a]
Perimeter of thorax	90.39	5.92	90.03	5.34	0.47
Thorax perimetral index	52.91	3.67	52.24	3.05	1.47
Biacromial breadth	38.77	1.61	39.15	1.86	1.66
Index of biacromial breadth	22.69	1.01	22.71	1.07	0.14
Bicristal pelvic breadth	27.15	1.39	27.18	1.60	0.15
Bicristal pelvic breadth index	15.89	0.788	15.76	0.801	1.23
Head length	193.7	7.06	194.6	6.66	1.0
Head breadth	154.3	5.46	152.8	5.61	2.02[a]
Cephalic index	79.77	4.08	78.60	3.67	2.24[a]

[a] Significant at the 5 percent level.

more mesocephalic. Finally, facial hair is reduced in big Parisian families, though not significantly.

2. The differences in socioprofessional composition of both samples is partly responsible for the prevalence of the slender type among Parisians. In fact, among them there is a fair number of students, while there are no farmers. In the other group farmers are not by any means numerous; however, one of us (Olivier 1970b) showed that there is a slight tendency for the professional characteristics of the father to be repeated in the son, whether this is a hereditary trait, or the outcome of living in the same environment, or both. Accordingly, we shall exclude sons of agricultural workers from the Seine-et-Marne sample. Differences in type tend to fade, as is seen in the comparison between the t tests in Table 4. The reduction of the t tests might be due to that of members; however, there are only thirteen fewer farmers' sons, which has no influence and

Table 4. Characteristics of samples excluding sons of agricultural workers

	Seine (n = 235)		Seine-et-Marne (n = 102)		New	Old
	mean	σ	mean	σ	t test	t test
Stature	171.86	5.94	171.53	5.38	0.50	0.60
Weight	63.77	7.60	66.04	7.84	2.46[a]	2.98[b]
Livi's ponderal index	23.23	0.88	23.55	0.83	3.19[b]	3.63[b]
Thorax perimetral index	52.50	3.46	53.16	3.08	2.32[a]	2.34[a]
Biacromial breadth index	22.72	1.03	22.93	1.03	1.72	2.08[a]
Bicristal breadth index	15.80	0.80	16.02	0.69	2.56[a]	3.39[b]
Head length	194.20	6.79	193.0	6.45	1.52	1.98[a]

[a] Significant at the 5 percent level.
[b] Significant at the 1 percent level.

proves the existence of a small aliquot of rural broad types. Since students are taller and more numerous in Paris, one might logically surmise that they introduce a leptosomatic element, if only because of their higher stature. But we see in Table 5 that this is not the case at all. Hence, differences in absolute and relative weights are maintained, and the reduced samples also help to diminish the significance of differences. While on the subject, we can remark that the greater length of the head is no longer explainable, and it could also be shown that the percentages of facial hair have remained constant.

Table 5. Characteristics of samples excluding both students and sons of agricultural workers

	Seine (n = 142)		Seine-et-Marne (n = 85)		Old	New
	mean	σ	mean	σ	t test	t test
Stature	171.24	6.09	171.74	5.37	0.65	0.60
Weight	62.98	7.71	66.48	7.73	3.30[b]	2.98[b]
Livi's ponderal index	23.21	0.96	23.57	0.82	3.01[b]	3.63[b]
Thorax perimetral index	52.52	3.47	53.22	3.12	1.57	2.34[a]
Bicristal breadth index	22.74	1.06	22.89	1.06	0.98	2.08[a]
Head length						

[a] Significant at the 5 percent level.
[b] Significant at the 1 percent level.

In part, the slender type of the native Parisians is unexplained in these samples by the composition of family and profession. For an explanation one must cast away the idea of a delay which would affect body girth alone: as is known, puberty occurs earlier among young people in towns, and this is accompanied by ponderal and body-breadth development.

On the other hand, without bringing up Villermé (1829), who in any case dealt only with stature, one might devise an analogy with the African observations made by Hiernaux (1965). In a single population, better living conditions during childhood produce people who are heavier and broader and have bigger heads (without changes in the cephalic-facial index). In our case, the head size does not differ, although the skull is longer. Alternatively, the Parisian slender type could be attributed to unstable living conditions in a capital city, due to less healthy diet, heavier pollution, reiterated stress, and even milder climate. This is not contrary to some observations previously reported by one of us (Olivier 1971) to the effect that there was a similarity between town and country dwellers: this was with reference to ordinary towns, not the metropolis. In order to establish which are the factors involved, one should resort to inventories concerning towns of various sizes.

In any event, the conclusion is inescapable that the diversity in the ponderal delay, the increased head length, and the decrease in facial hair

are due to heredity. This means that the external pressures of the capital, as far as anthropology is concerned, leave very little trace. Maybe the heterogeneity of the population of a big city is likely to give rise to some rectification of the differences it creates. According to Pourcher (1964), immigrants to Paris originate from Bretagne (15 percent), Southwest (12.9 percent), Normandy (10.3 percent). Emigration from the center is less than one would imagine: 6.4 percent for Auvergne and Limousin combined.

This explains why Parisians most resemble their geographic neighbors from the Ile-de-France. In any case, the majority of towns have come into existence at the expense of the nearest country areas.

Mental Capacity

This assessment is provided by applying the French army test "niveau général." Table 6 shows that Parisians get better marks than their neighbors in Seine-et-Marne. This is easily understood. First of all, this test must be assessed in relation to the value of the intelligence quotient (I.Q.).

By definition, the "general level is a common measure given to all recruits (to the army) so that they may be classed on the basis of general intelligence without recourse to specialization." To achieve this we examine general reasoning capacity, writing ability, ability in symbol interpretation, capacity to solve problems of a mathematical type, and practical cleverness. To do this a group of four tests is used with a multiple choice of answers:

1. puzzle test, to evaluate Speerman's G factor;
2. mechanical test, to evaluate practical and technological intelligence;
3. mathematical test, which assesses both mathematical reasoning and school background;
4. lastly, a test in three cyclic phases, to evaluate verbal intelligence and logical common sense.

Marks given are from 1 to 20. The general level is then decided in a different way from the I.Q., though it explores similar mental capacities and is similar to it in many ways. An I.Q. of 100 corresponds to a "general level" of 8 to 12. A criticism of all these tests is that they tend to favor symbolic intelligence, thereby leading to the tendency to underrate certain professional groups, such as, for instance, agricultural workers.

This, in any case, is the reason for the better average results yielded by Parisians (three points higher; see Table 1). If we subdivide the global results into professional categories, we obtain Table 6.

The Parisians are obviously no more intelligent than their neighbors; their superior marks are due to the larger number of students in their

Table 6. General level by professions

	Paris (Seine)			Seine-et-Marne			
	n	*m*	σ	*n*	*m*	σ	*t* test
Unqualified workers	73	7.64	4.81	45	7.06	3.58	0.74
Qualified workers	67	11.43	4.23	27	8.70	4.37	2.75[a]
Employees	46	12.28	4.45	18	13.06	4.86	0.59
Total of nonstudents	186	9.94	5.23	90	8.75	4.65	1.77
Students	126	16.94	2.84	19	15.58	3.15	1.78

[a] Significant at the 1 percent level.

sample. If we discount this group the difference is no longer significant. Another proof of this biased tendency is provided by the difference between the two Parisian samples (columns 1 and 3 in Table 1). The second sample contains more students, who succeed better in these tests. The same would be true if we compared Paris and suburbs in subdividing the sample.

However, there is a slight preponderance in the number of Parisians in each profession (employees excepted); confirmation of this has been possible with similar groups from another area (Normandy) which were examined at the same time. As this particular study is concerned with "sedentary" subjects alone, and as in this case one cannot bring up the question of the effect of heterosis, it is possible that psychical maturation (through "group effect") is more precocious in the large cities, tending to lead to better intellectual development, or at any rate to better responses to mental ability tests. But there is nothing which justifies recourse to a hereditary factor.

CONCLUSIONS AND SUMMARY

In order to study the characteristics of immigrants and the effects of urbanization, we assembled morphological data on native citizens, which in this case were Parisians born of Parisians, who displayed special characteristics:

1. Sedentariness is reflected in smaller stature than one would have expected when taking into account diachronic growth. The other Parisians are taller.

2. A "leptosomatic" type is evident among all Parisians, native or not, as compared to the surrounding population, even taking into account the socioprofessional makeup. This type is characteristically lighter in weight. Different explanations have been offered though no conclusion has been reached. What in fact is lacking is precise definition of "the way

of life" in large cities; quite likely this is an adaptation peculiar to urbanization.

3. Heads are longer and facial hair slightly less pronounced than in neighboring populations; no other explanation can be given for this than different heredity arising from the heterogeneity of the Paris population. The latter, therefore, influences few of these traits and is apparently less important than one would think.

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The Distribution of ABO and Rh Blood Groups in Greece

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Populational studies on blood-group frequencies started in Greece at the Macedonian front during the First World War, when Professor and Mrs. Hirszfeld (1919) studied a number of soldiers and other persons from different countries. Five hundred Greeks were included in their samples. Since then a number of investigators, mostly Greek, have published numerous studies, chiefly on ABO blood-group distribution, of Greek populations (Savas 1927; Koumaris 1927; Diamantopoulos 1928; Pangalos 1930; Sfetikopoulos 1938; Paidoussis 1938; Papamarkou and Sklepa, 1941; Stavropoulos 1942; Alivizatos and Sklepa 1948, 1949a, 1949b; Pangalos et al. 1951, Choremis et al. 1953; Moschonas 1955; Markianos et al. 1957; Constantoulis and Paidousis 1958; Achimastos and Paizis 1969). Most of these studies dealt with selected samples (patients and their relatives, blood-bank donors), while it appears that in the early ones, unreliable test serums or techniques were used. The reliability of a recent large-scale study by Valaoras (1970) could also be questioned, since a considerable number of errors in type determination and/or data transcription has been officially recognized (Arabatzis et al. 1970). Several authors, on the other hand, studied local or regional samples of Greek population and showed an important degree of heterogeneity (Barnicot et al. 1965; Stamatoyannopoulos and Fessas 1964; Roberts et al. 1965; Fraser et al. 1969; Xirotiris 1971). The present study is an attempt to cover with nonselective samples and reliable data nearly all regional Greek populations. The data of this study are also discussed with regard to their anthropological significance.

MATERIAL AND METHODS

The main sample, 34,437 subjects, was drawn from male recruits of the military classes of 1960 through 1970. Since military service is compulsory for all able young men upon reaching their twentieth birthday (with some exceptions), and since this sample was drawn randomly from the total number of all male recruits of the classes of these years, it is a nonselective sample, a stratified sample with regard to age, and a sample representing, proportionally to their population, all provinces and regions of Greece. In most of the previously mentioned investigations, samples have been either selective (blood-bank donors, patients and their relatives) or nonstratified with regard to age. To this sample, 2,173 university students have been added (also an age-stratified sample and of an age similar to that of the recruits). All of them were typed for ABO and Rh (D) blood groups. Smaller fractions of these samples have been typed for A_1A_2BO blood groups (2,627 subjects) and for complete Rh blood groups (4,489). Another sample, 1,261 subjects, not stratified by age or sex, was sampled from the population of the island of Chios for complete Rh blood groups.

ABO typing was done in two ways for the same subject: first by using anti-A and anti-B serums on his red cells and second by typing his serum with known ABO red cells. Thus the typing error is reduced nearly to nil. For A subgroups we used an anti-A_1 serum (lectin) from extraction of *Dolichos biflorus* seeds and adsorbed on human serum. In all subjects an anti-D serum was used to determine Rh positive or negative individuals; but when a complete Rh blood-group determination was performed, anti-C, anti-E, anti-c, and anti-e serums were also used. The typing of D^u was done according to Coombs test using human antiglobin serum.

All typings were performed personally by one of us. A card was completed for each subject, on which, in addition to his name, age, and blood-group phenotype, his place of birth and origin were indicated. Thus we could classify our data according to the places of origin of the subjects typed. The regions of Greece which we used in classifying our data follow not the administrative subdivisions of the country but a more natural and meaningful geographic subdivision. Thus, big cities have been classified apart (Athens, Piraeus, Salonica); Macedonia was split into four parts: the eastern, between the Strymon and Nestos rivers; the central, between the Strymon and Axios rivers; Khalkidhiki; and finally the western, beyond the Axios River. In Figure 1 we have shown in black the regions not included in our sample: either those belonging to adjacent countries (e.g. the islands of Tenedos and Imbros), or those unsuitable for various reasons (Mount Athos, which does not have a Mendelian population, Delos and other desert islands, or places with a very small population).

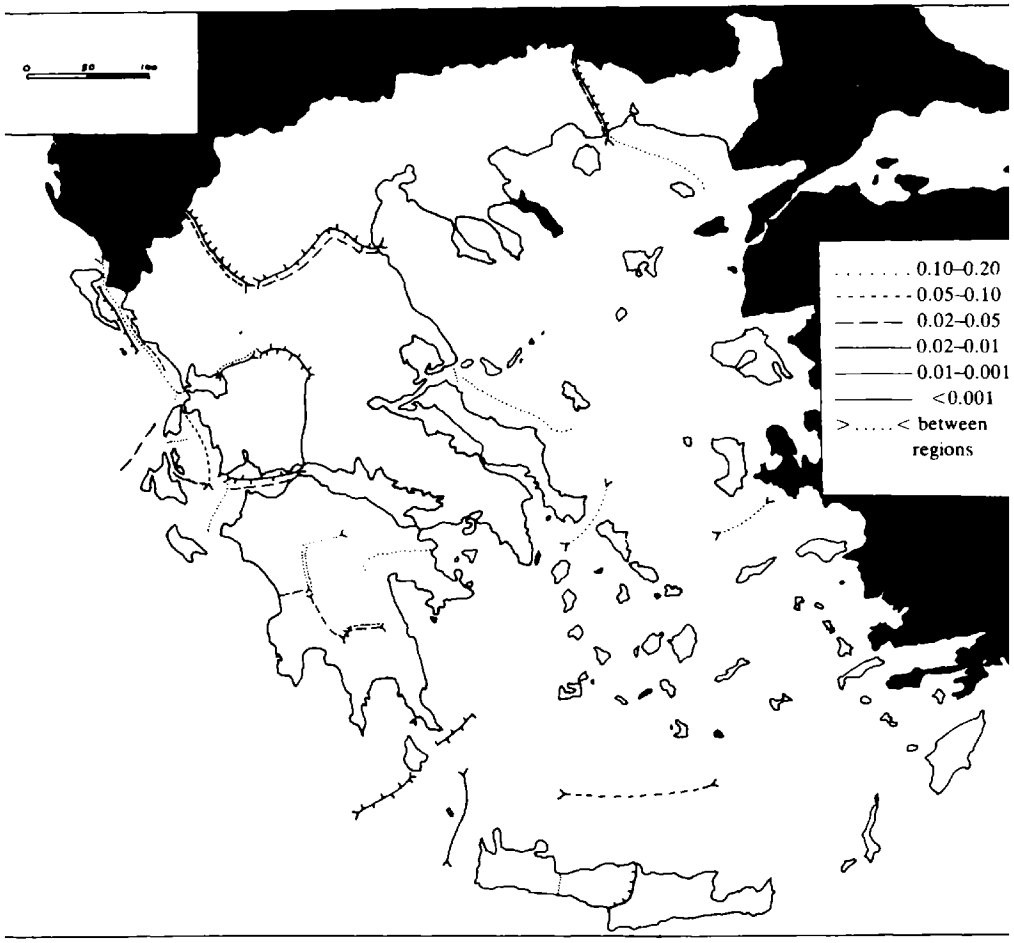

Figure 1. Statistically significant results of chi-square homogeneity tests showing how Greece can be subdivided according to ABO distribution (black regions are those not sampled)

Allele frequencies of the ABO blood groups have been estimated according to Mourant et al. (1958) (in Table 2 we actually followed their manner of reporting the data). The estimation of the complete Rh alleles was based on the probable genotypes derived from the phenotypes detected. Finally, for estimating A_1A_2BO allele frequencies we used the method of maximum likelihood (where $I^{A1}I^{A2}$ genotype was taken as A_1 phenotype) supposing that the samples were drawn from a panmictic population. The actual values of allele frequencies were derived using the computer of the Democritus Nuclear Center with a program written by Mr. J. Sourdis.

RESULTS

The original recruit data were classified in two samples, the first consolidating the years of 1960 through 1965, the second the years of 1965

through 1970. However, since chi-square homogeneity tests between the two samples within the same region did not detect heterogeneity (of twenty-nine such tests, only two, those of Arcadia and Lemnos, were significant at the 0.02 and 0.05 probability levels, respectively), we consolidated all these data.

The first question to be asked is whether all our regional samples are homogeneous, drawn from the same population. A total chi-square test for Rh positive and negative subjects showed no signs of heterogeneity ($\chi^2 = 35.423$ for 9 d.f., $0.10 < P < 0.20$). Furthermore, a chi-square test for the Cyclades also proved to be nonsignificant ($\chi^2 = 6.792$ for 8 d.f., $0.50 < P < 0.70$), whereas the one for ABO blood groups is highly significant. However, since the level of significance is also a function of the size of the samples, we decided to indicate in Figure 2 the distribution of the d allele frequency. In all the figures, we indicate higher frequencies with blacker shadowing. It can be easily seen that there is a general tendency (not without exceptions, however: e.g. Dodecanese, Zante, Cephallonia) to get higher frequencies in the eastern parts of the country, in the north

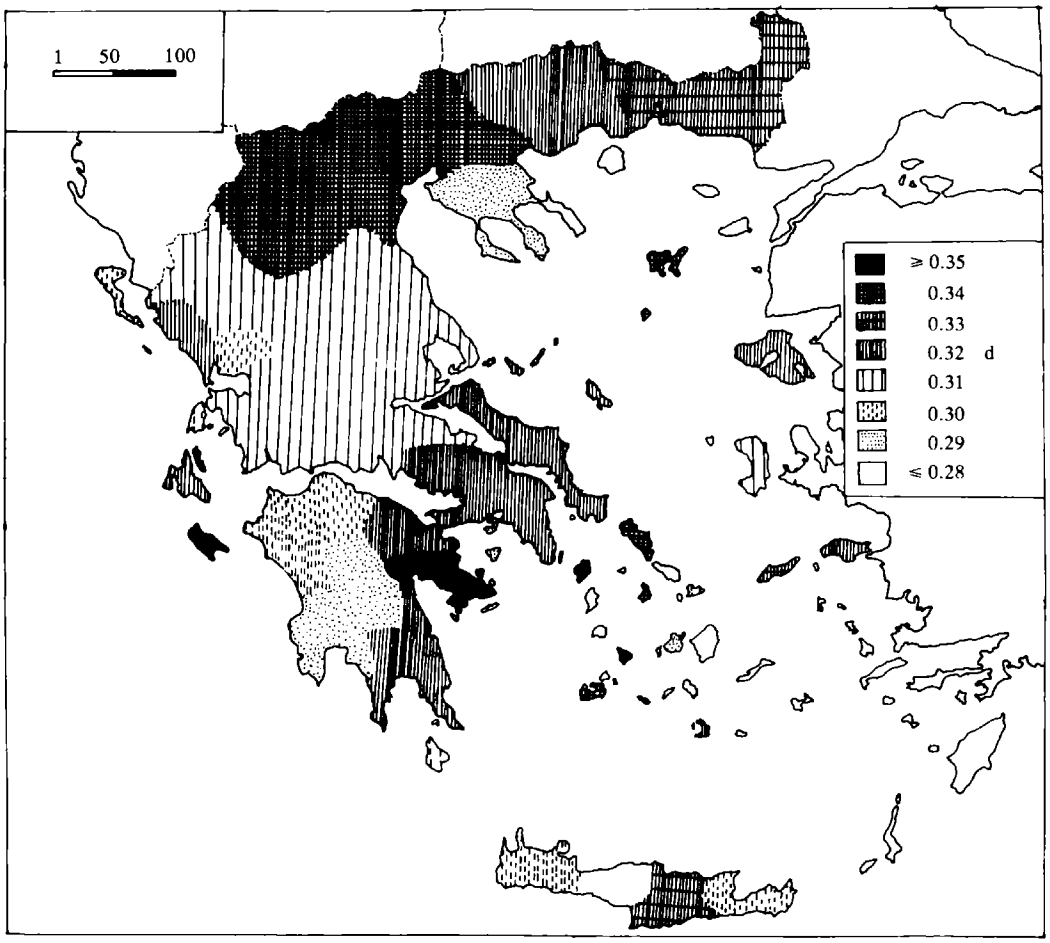

Figure 2. Distribution of the frequency of d in Greece

as well as in the Peloponnesus. It would be interesting for further investigation to reaffirm or disprove this pattern. That the general population should not be homogeneous for the complete Rhesus alleles (e.g. the frequency of r in the totals for Greece and Chios) is shown in our data (reported in Table 7) as well as in the data of other authors. These are significant but very sketchy data, however, and no general pattern can be derived from them now.

The situation is different for ABO blood groups: a significant heterogeneity is obvious, and the wealth of data permits a more detailed study. We have decided not to follow Kopeć's strategy (1970) in our analysis, that is, to analyze each allele independently as she did for the English populations. We preferred to examine whether adjacent regions were or were not homogeneous, performing a usual chi-square test on the phenotype classes found. When a number of adjacent regions, tested two by two, were found not to be heterogeneous, we performed total chi-square homogeneity tests for all these regions. The data for all these 158 chi-square tests are indicated in Table 1. When a significant

Table 1. Homogeneity chi-square tests between adjacent regions or groups of regions for ABO blood-group phenotypes

Pairs or groups[a] of regions	χ^2	Degrees of freedom	Probability	Phenotypes and/or regions that contribute most to heterogeneity
1. Thrace (Christians)–Thrace (Moslems)	5.864	3	0.10–0.20	
2. Thrace (Moslems)–Macedonia	19.237	3	<0.001	
3. Thrace (Christians)–Samothrace, Thassos	5.447	3	0.10–0.20	O, A
4. Thrace (Christians)–Macedonia	15.392	3	0.001–0.01	O, B, AB
5. Thrace (Christians)–East Macedonia	10.445	3	0.02–0.05	AB, B, O
6. East Macedonia–central Macedonia–West Macedonia–Khalkidhiki	4.561	9	0.80–0.90	
7. East Macedonia–Samothrace, Thasos	3.701	3	0.20–0.30	
8. Macedonia–Samothrace–Thasos	3.130	3	0.30–0.50	
9. Macedonia–Epirus	13.351	3	0.001–0.01	A, B, O
10. West Macedonia–Epirus	6.826	3	0.05–0.10	B, A
11. Janina–Preveza–Arta–Dodoni–Filiates	8.020	12	0.70–0.80	
12. Janina–West Macedonia	3.630	3	0.30–0.50	
13. Macedonia–Thessaly	24.801	3	<0.001	O, A, B
14. West Macedonia–Thessaly	8.871	3	0.02–0.05	A, B

Table 1 (*continued*).

Pairs or groups[a] of regions	χ^2	Degrees of freedom	Probability	Phenotypes and/or regions that contribute most to heterogeneity
15. Janina–Dodoni	1.093	3	0.70–0.80	
16. Janina–Filiates	4.596	3	0.20–0.30	
17. Filiates–Preveza	4.154	3	0.20–0.30	
18. Preveza–Arta	1.249	3	0.70–0.80	
19. Dodoni–Arta	1.023	3	0.70–0.80	
20. Dodoni–Preveza	1.477	3	0.50–0.70	
21. Epirus–Ionian Islands	5.126	3	0.10–0.20	B
22. Epirus–Corfu	13.430	3	0.001–0.01	B, O
23. Filiates–Corfu	14.347	3	0.001–0.01	B, O, AB
24. Janina–Corfu	3.167	3	0.50–0.70	
25. Leukas–Arta	0.785	3	0.80–0.90	
26. Preveza–Corfu	7.376	3	0.05–0.10	B, O
27. Preveza–Leukas	2.463	3	0.30–0.50	
28. Corfu–Leukas–Cephallonia–Ithaca–Zante–Cerigo	22.222	13	≃0.05	O, B
29. Dodoni–Thessaly	0.160	3	0.98–0.99	
30. Janina–Thessaly	1.419	3	0.70–0.80	
31. Epirus–Thessaly	0.731	3	0.80–0.90	
32. Thessaly–Sporades	2.505	3	0.30–0.50	
33. Epirus–Aetolia, Acarnania	11.739	3	0.01–0.02	O, B, AB
34. Preveza–Aetolia, Acarnania	3.799	3	0.20–0.30	
35. Arta–Aetolia, Acarnania	5.979	3	0.10–0.20	B, O
36. Ionian Islands–Aetolia, Acarnania	7.559	3	0.05–0.10	AB
37. Epirus–Aetolia, Acarnania–Ionian Islands	16.235	6	0.01–0.02	Aetolia, Acarnania–Epirus
38. Corfu–Aetolia, Acarnania	1.964	3	0.50–0.70	
39. Leukas–Aetolia, Acarnania	3.417	3	0.30–0.50	
40. Cephallonia–Aetolia, Acarnania	9.147	3	0.02–0.05	AB, O
41. Cephallonia–Ithaca	3.589	3	0.30–0.50	
42. Cephallonia–Corfu	10.118	3	0.02–0.05	O, AB, B
43. Ithaca–Corfu	3.153	3	0.30–0.50	
44. Leukas–Cephallonia	1.323	3	0.50–0.70	
45. Leukas–Ithaca	5.122	3	0.10–0.20	B, A
46. Zante–Ithaca	3.687	3	0.20–0.30	
47. Aetolia, Acarnania–Thessaly	17.168	3	<0.001	O, B, AB
48. Thessaly–Phthiotis, Phocide	4.192	3	0.20–0.30	
49. Aetolia, Acarnania–Phthiotis, Phocide	9.617	3	0.01–0.02	B
50. Phthiotis, Phocide–Boeotia	2.218	3	0.50–0.70	
51. Boeotia–Euboea	0.194	3	0.95–0.98	
52. Euboea–Attica	3.103	3	0.30–0.50	

Table 1 (*continued*).

Pairs or groups[a] of regions	χ^2	Degrees of freedom	Probability	Phenotypes and/or regions that contribute most to heterogeneity
53. Boeotia–Attica	2.151	3	0.50–0.70	
54. Attica–Corinthia	0.843	3	0.80–0.90	
55. Corinthia–Argolide	4.988	3	0.10–0.20	B
56. Corinthia–Phthiotis, Phocide	3.003	3	0.30–0.50	
57. Corinthia–Achaïa, Elis	0.635	3	0.80–0.90	
58. Corinthia–Achaïa	0.127	3	0.98–0.99	
59. Achaïa–Elis	3.076	3	0.30–0.50	
60. Achaïa, Elis–Arcadia, Kynouria	5.811	3	0.10–0.20	B, A
61. Arcadia–Achaïa	2.156	3	0.50–0.70	
62. Arcadia–Elis	5.682	3	0.10–0.20	B
63. Arcadia–Kynouria	0.387	3	0.90–0.95	
64. Elis–Messenia	8.623	3	0.02–0.05	O, B
65. Corinthia–Arcadia, Kynouria	1.801	3	0.50–0.70	
66. Achaïa, Elis–Ionian Islands	4.896	3	0.10–0.20	B, O
67. Aetolia, Acarnania–Achaïa, Elis	19.042	3	<0.001	O, B, AB
68. Achaïa–Zante	2.730	3	0.30–0.50	
69. Zante–Cephallonia	0.665	3	0.80–0.90	
70. Achaïa–Aetolia, Acarnania	9.718	3	0.02–0.05	O, AB
71. Elis–Aetolia, Acarnania	19.749	3	<0.001	O, B, AB
72. Cephallonia–Elis	0.675	3	0.80–0.90	
73. Ithaca–Aetolia, Acarnania	3.599	3	0.30–0.50	
74. Elis–Zante	2.034	3	0.50–0.70	
75. Argosaronicos Islands–Attica	0.591	3	0.80–0.90	
76. Argosaronicos Islands–Argolide	3.419	3	0.30–0.50	
77. Euboea–Sporades	5.727	3	0.10–0.20	B, AB, O
78. Sporades–Phthiotis, Phocide	5.128	3	0.10–0.20	A, AB, O
79. Argosaronicos Islands–Corinthia	0.356	3	0.90–0.95	
80. Argosaronicos Islands–Cyclades	0.361	3	0.90–0.95	
81. Corinthia–Boeotia	0.240	3	0.95–0.98	
82. Argolide–Kynouria	5.523	3	0.10–0.20	B, A
83. Kynouria–Laconia	2.745	3	0.30–0.50	
84. Laconia–Arcadia	6.706	3	0.05–0.10	O, A
85. Laconia–Argolide	11.651	3	0.001–0.01	B, O
86. Messenia–Achaïa, Elis	6.815	3	0.05–0.10	O, B
87. Messenia–Arcadia, Kynouria	6.308	3	0.05–0.10	A
88. Laconia–Messenia	4.080	3	0.20–0.30	
89. Laconia–Messenia–Arcadia, Kynouria	12.089	6	0.05–0.10	A, O, Arcadia
90. Laconia–Arcadia	6.706	3	0.05–0.10	A, O

Table 1 (*continued*).

Pairs or groups[a] of regions	χ^2	Degrees of freedom	Probability	Phenotypes and/or regions that contribute most to heterogeneity
91. Laconia–Arcadia, Kynouria	7.815	3	0.05–0.10	A, O
92. Laconia–Cerigo	0.209	3	0.90–0.95	
93. Laconia–Canea	17.248	3	<0.001	O, AB, A
94. Laconia–Herakleion	12.384	3	0.001–0.01	A, B, O
95. Cerigo–Messenia	0.206	3	0.90–0.95	
96. Cerigo–Canea	1.666	3	0.30–0.50	
97. Laconia–Argolide–Arcadia, Kynouria	22.976	6	<0.001	B, Argolide
98. Argolide–Arcadia, Kynouria	13.316	3	0.001–0.01	A, B
99. Corinthia–Argolide–Arcadia, Kynouria	15.729	6	0.01–0.02	B, Argolide
100. Achaïa, Elis–Arcadia, Kynouria–Messenia	12.546	6	≃0.05	B, O, A. Messenia, (Arcadia, Kynouria)
101. Crete–Laconia	17.935	3	<0.001	O, A, AB
102. Crete–Messenia	12.911	3	0.001–0.01	A, O
103. Crete–Ionian Islands	9.503	3	0.02–0.05	A, O
104. Argolide–Arcadia, Kynouria–Achaïa, Elis –Corinthia–Laconia–Messenia	33.602	15	0.001–0.01	O, B, Argolide, Laconia
105. Canea–Rethymno–Herakleion–Lasithi	17.020	9	0.02–0.05	B, AB, O
106. Canea–Rethymno	1.914	3	0.50–0.70	
107. Rethyno–Herakleion	5.604	3	0.10–0.20	AB
108. Canea–Rethymno, Herakleion	11.794	3	0.001–0.01	B, AB, O
109. Canea–Rethymno–Herakleion	16.071	6	0.01–0.02	B, AB, O
110. Canea, Rethymno–Herakleion	14.458	6	0.001–0.01	AB, B, O
111. Herakleion–Lasithi	0.376	3	0.95–0.98	
112. Rethymno-Herakleion–Lasithi	5.622	6	0.20–0.30	
113. Canea, Rethymno–Herakleion, Lasithi	14.647	3	0.001–0.01	AB, B, O
114. Zante–Herakleion	10.036	3	0.02–0.05	B, AB
115. Zante–Canea	0.051	3	0.99–1.00	
116. Cyclades–Attica	1.380	3	0.70–0.80	
117. Cyclades–Euboea	1.361	3	0.70–0.80	
118. Chios–Cyclades	5.454	3	0.10–0.20	B, AB
119. Cyclades–Samos, Icaria	0.500	3	0.90–0.95	
120. Crete–Dodecanese	2.507	3	0.30–0.50	
121. Cyclades–Dodecanese	2.681	3	0.30–0.50	
122. Cyclades–Crete	6.781	3	0.05–0.10	A, B
123. Cyclades–Lesbos	2.604	3	0.30–0.50	
124. Chios–Samos	4.098	3	0.20–0.30	
125. Samos–Icaria	1.712	3	0.50–0.70	
126. Dodecanese–Lasithi	1.951	3	0.50–0.70	
127. Dodecanese–Icaria	1.951	3	0.50–0.70	
128. Chios–Icaria	1.912	3	0.50–0.70	

Table 1 (*continued*).

Pairs or groups[a] of regions	χ^2	Degrees of freedom	Probability	Phenotypes and/or regions that contribute most to heterogeneity
129. Dodecanese–Samos	0.096	3	0.99–1.00	
130. Lemnos–Samothrace, Thasos	1.638	3	0.50–0.70	
131. Lemnos–Sporades	1.399	3	0.70–0.80	
132. Lemnos–Lesbos	1.599	3	0.50–0.70	
133. Lesbos–Chios	2.140	3	0.50–0.70	
134. Chios–Samos, Icaria	3.882	3	0.10–0.20	B, AB
135. Sporades–Epirus–Thessaly–Phthiotis, Phocide–Boeotia–Attica–Euboea–Corinthia–Arcadia, Kynouria–Achaïa, Elis	29.450	30	0.30–0.50	Phthiotis, Phocide, Arcadia
136. Samothrace, Thasos–Lemnos–Lesbos–Chios–Samos, Icaria–Dodecanese–Cyclades–Sporades–Euboea–Argosaronicos Islands–Crete	36.842	30	0.10–0.20	Crete, Euboea, Cyclades, Chios
137. Samothrace, Thasos–Lemnos–Lesbos–Chios–Samos, Icaria–Dodecanese–Cyclades–Sporades–Euboea–Argosaronicos Islands–Crete–Epirus–Thessaly–Phthiotis, Phocide–Boeatia–Attica–Arcadia, Kynouria–Achaïa, Elis–Corinthia–Ionian Islands	82.213	57	0.01–0.02	Crete, Phthiotis, Phocide, Chios, Thessaly, Arcadia, Kynouria, Sporades
138. Aetolia, Acarnania–Laconia–Messenia	7.064	6	0.30–0.50	
139. Tinos–Andros–Syros–Paros–Thera–Melos–Naxos–Myconos, Kythnos, Ios, Kimolos, Polycandro, Sikinos, Kea, Serifos, Amorgos, Anafi, Sifnos	49.581	21	<0.001	B, O, AB
140. Tinos–Syros–Paros–Thera–Naxos–Myconos, Kythnos, Ios, Kimolos, Polycandro, Sikinos, Kea (Group 1: high o)	18.936	15	0.20–0.30	
141. Andros–Melos–Sifnos, Serifos, Amorgos, Anafi (Group 2: low o)	3.601	6	0.70–0.80	
142. Group 1–Group 2	44.663	3	<<0.001	B, O
143. Group 1–Chios	4.128	3	0.20–0.30	

Table 1 (*continued*).

Pairs or groups[a] of regions	χ^2	Degrees of freedom	Probability	Phenotypes and/or regions that contribute most to heterogeneity
144. Group 2–Chios	34.091	3	<<0.001	B, O, AB
145. Group 1–Samos	8.116	3	0.02–0.05	O, B
146. Group 2–Samos	7.239	3	0.05–0.10	O, B
147. Group 1–Icaria	1.566	3	0.50–0.70	
148. Group 2–Icaria	9.450	3	0.02–0.05	O, B
149. Group 1–Dodecanese	14.213	3	0.001–0.01	O, B, A
150. Group 2–Dodecanese	14.302	3	0.001–0.01	B, O
151. Group 1–Canea	19.801	3	<0.001	O, A, AB
152. Group 2–Canea	10.070	3	0.01–0.02	B, O
153. Group 1–Herakleion	7.614	3	0.05–0.10	A, O
154. Group 2–Herakleion	37.860	3	<<0.001	B, O, AB
155. Group 1–Euboea	4.773	3	0.10–0.20	A
156. Group 2–Euboea	28.159	3	<<0.001	O, B
157. Group 1–Attica	13.895	3	0.001–0.01	B, O, AB
158. Group 2–Attica	16.292	3	<<0.001	O, B

[a] A dash between regions indicates separate testing for homogeneity, while a comma indicates that the regions were combined for testing.

heterogeneity was found we also indicated the phenotypes which contribute most to the chi-square value, in the case of comparison of two samples, and the regions that contribute most to the chi-square values, in the case of a test for a group of more than two regions. Of these tests, fifteen are significant at $P < 0.0001$, fifteen at a level between 0.001 and 0.01, seven at a level between 0.01 and 0.02, eleven at a level between 0.02 and 0.05, fourteen at a level between 0.05 and 0.10, and seventeen at a level between 0.10 and 0.20. Although these chi-square tests are not independent (the same regions were used several times), there is no reasonable doubt that we are dealing with nonhomogeneous samples. We have attempted to indicate in Figure 1 some of these significant results: the significant levels (with a different marking according to the level) between two regions are indicated on this map. Tests between adjacent but small regions are indicated differently from tests performed on adjacent but larger regions, e.g. between Thrace and East Macedonia or between Thrace and Macedonia. Figure 1 also shows the marking used for tests between larger regions.

It can be seen from Table 1 and Figure 1 that Greece is subdivided into several regions: Thrace, Macedonia, Aetolia and Acarnania, Corfu, southern Peloponnesus (Messenia, Laconia, Kynouria?, Cerigo), West Crete, and remaining regions. Even then the remaining regions are not homogeneous. The Cyclades, for example, show great heterogeneity and a not-completely-objective (that is to say not mechanically derived, as are the previously mentioned results) subdivision, but one suggested by the

data, into two groups according to the frequency r of ABO gene (high and low respectively), which can account for the greater part of the heterogeneity found. Tests for total heterogeneity between the remaining regions are also significant, showing other spots of local differentiation (e.g. Argolide) or differentiation due to frequency clines.

In Table 2 we report the allele frequency data together with the raw observation data for the ABO and Rh blood groups. These numerous data for ABO have also been mapped in Figures 3, 4, and 5, indicating the distribution of the allele frequencies in Greece.

A comparison of Figure 1 and these figures is interesting and suggestive. The regions of Aetolia and Acarnania and those of the southern Peloponnesus are both characterized by a high O, low B frequency. The same is true for Corfu. Khalkidhiki shows a higher O, lower B frequency than Macedonia to the north. In Table 3, the sample from Khalkidhiki is well in accord with ours, corroborating that even if not differing at a statistically significant level in our data, the differences are real. On the other hand it seems that there is a gradient of increasing O frequency

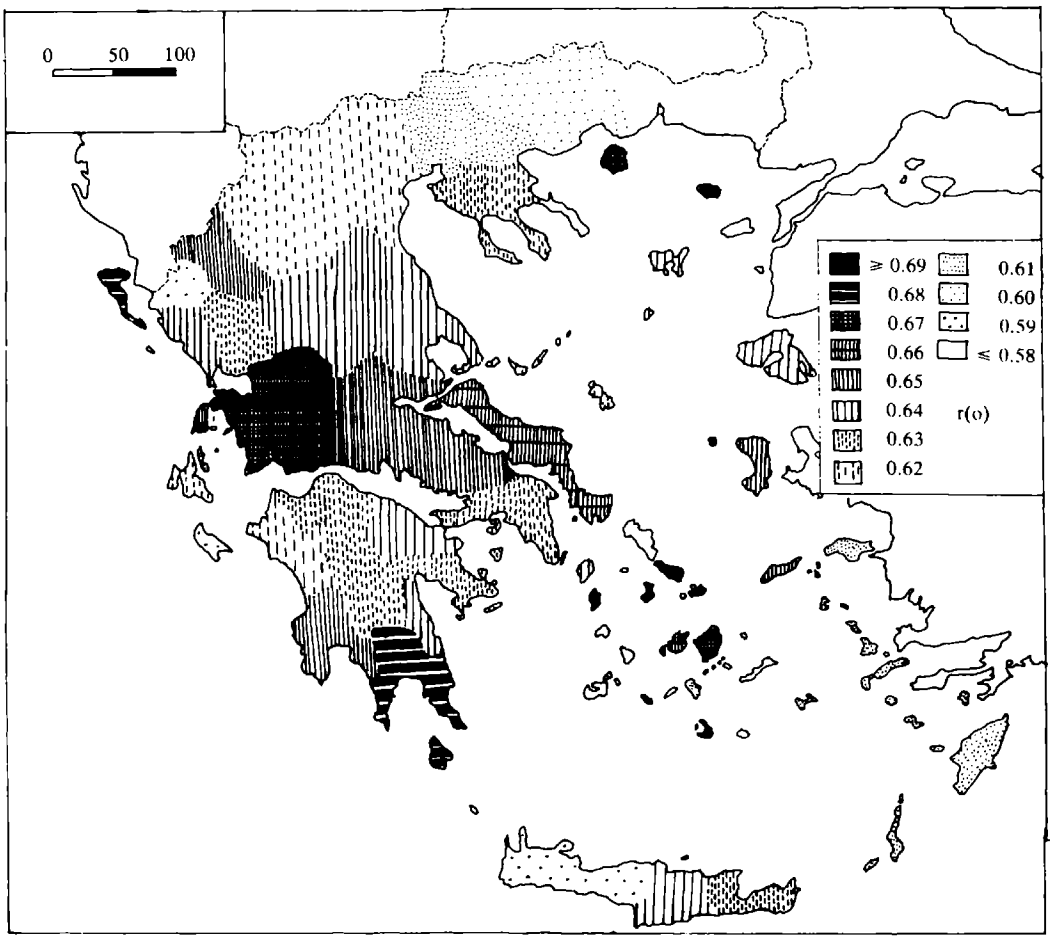

Figure 3. Distribution of the frequency of r(O) in Greece

Table 2. Data on the frequencies (number and percentage) of blood groups ABO and Rh of different regions of Greece from army conscripts of 1960–1970 and from a students' sample

Region	Number of subjects	O	A	B	AB	p	q	r	D/σ^a	Rh(D)+	Rh(D)−	D	d
1. Thrace (Christians)	1,374	459	607	212	96					1,220	154		
	%	0.3341	0.4418	0.1543	0.0699	0.3014	0.1193	0.5793	+0.36	0.8879	0.1121	0.6652	0.3348
2. Thrace (Moslems)	686	246	269	126	45					602	84		
	%	0.3586	0.3921	0.1837	0.0656	0.2444	0.1353	0.6203	+0.66	0.8776	0.1224	0.6501	0.3499
3. Macedonia	5,886	2,222	2,584	759	321					5,249	637		
	%	0.3775	0.4390	0.1290	0.0545	0.2896	0.0968	0.6136	+0.45	0.8918	0.1082	0.6711	0.3289
a. East Macedonia	2,133	788	954	277	114					1,901	232		
	%	0.3694	0.4473	0.1299	0.0535	0.2938	0.0964	0.6098	+0.77	0.8912	0.1088	0.6702	0.3298
b. Central Macedonia	334	126	149	41	18					295	39		
	%	0.3773	0.4461	0.1228	0.0539	0.2929	0.0926	0.6145	+0.04	0.8832	0.1168	0.6582	0.3418
c. Salonica	1,267	472	556	165	74					1,148	119		
	%	0.3725	0.4388	0.1302	0.0584	0.2909	0.0992	0.6099	−0.13	0.9061	0.0939	0.6936	0.3064
d. West Macedonia	1,851	718	788	241	104					1,629	222		
	%	0.3879	0.4257	0.1302	0.0562	0.2801	0.0979	0.6220	−0.30	0.8801	0.1199	0.6537	0.3463
e. Khalkidhiki	301	118	137	35	11					276	25		
	%	0.3920	0.4551	0.1163	0.0365	0.2881	0.0799	0.6320	+0.95	0.9169	0.0831	0.7117	0.2883
4. Epirus	1,354	551	530	211	62					1,219	135		
	%	0.4069	0.3914	0.1558	0.0458	0.2505	0.1068	0.6427	+1.50	0.9003	0.0997	0.6842	0.3158
a. Janina region	379	165	146	50	18					341	38		
	%	0.4354	0.3852	0.1319	0.0475	0.2467	0.0941	0.6592	−0.11	0.8997	0.1003	0.6834	0.3166
b. Preveza region	330	134	134	51	11					295	35		
	%	0.4061	0.4061	0.1546	0.0333	0.2529	0.0995	0.6477	+1.69	0.8939	0.1061	0.6743	0.3257
c. Arta region	273	109	105	47	12					247	26		
	%	0.3993	0.3846	0.1722	0.0440	0.2452	0.1152	0.6396	+1.07	0.9048	0.0952	0.6915	0.3085
d. Dodoni region	268	107	105	41	15					242	26		
	%	0.3993	0.3918	0.1530	0.0560	0.2570	0.1106	0.6324	+0.07	0.9030	0.0970	0.6886	0.3114
e. Filiates region	104	36	40	22	6					94	10		
	%	0.3462	0.3846	0.2115	0.0577	0.2549	0.1461	0.5990	+0.79	0.9038	0.0962	0.6898	0.3102
5. Thessaly	2,820	1,160	1,086	421	153					2,564	256		
	%	0.4114	0.3851	0.1493	0.0543	0.2510	0.1075	0.6415	−0.06	0.9092	0.0908	0.6870	0.3130
6. Aetolia, Acarnania	1,696	774	650	210	62					1,527	169		
	%	0.4564	0.3833	0.1238	0.0366	0.2386	0.0838	0.6776	+0.85	0.9004	0.0996	0.6844	0.3156
7. Phthiotis, Phocide	975	418	355	160	42					874	101		
	%	0.4287	0.3641	0.1641	0.0431	0.2307	0.1099	0.6594	+1.28	0.8964	0.1036	0.6871	0.3129

Table 2 (*continued*).

Region	Number of subjects	O	A	B	AB	p	q	r	D/σ*	Rh(D)+	Rh(D)−	D	d
8. Boeotia	360	155	142	48	15					323	37		
	%	0.4306	0.3944	0.1333	0.0417	0.2495	0.0918	0.6587	+0.45	0.8972	0.1028	0.6794	0.3206
9. Attica (land)	822	331	322	123	46					736	86		
	%	0.4027	0.3917	0.1496	0.0560	0.2568	0.1086	0.6346	−0.006	0.8954	0.1046	0.6766	0.3234
10. Athens	3,373	1,377	1,405	424	167					3,049	324		
	%	0.4082	0.4165	0.1257	0.0495	0.2693	0.0918	0.6389	−0.003	0.9039	0.0961	0.6900	0.3100
11. Piraeus	1,807	717	733	248	109					1,620	187		
	%	0.3968	0.4056	0.1372	0.0603	0.2688	0.1040	0.6272	−0.98	0.8965	0.1035	0.6783	0.3217
12. Argolide	458	178	171	88	21					401	57		
	%	0.3887	0.3734	0.1921	0.0459	0.2393	0.1278	0.6329	+1.64	0.8755	0.1245	0.6472	0.3528
13. Arcadia, Kynouria	605	244	266	69	26					552	53		
	%	0.4033	0.4397	0.1141	0.0430	0.2811	0.0820	0.6370	+0.44	0.9124	0.0876	0.7040	0.2960
a. Arcadia	485	195	212	56	22					445	40		
	%	0.4021	0.4371	0.1155	0.0454	0.2808	0.0840	0.6352	+0.23	0.9175	0.0825	0.7128	0.2872
b. Kynouria	120	49	54	13	4					107	13		
	%	0.4083	0.4500	0.1083	0.0333	0.2821	0.0738	0.6442	+0.55	0.8917	0.1083	0.6709	0.3291
14. Achaïa, Elis	2,512	996	1,019	365	132					2,279	233		
	%	0.3965	0.4057	0.1453	0.0525	0.2642	0.1044	0.6314	+0.70	0.9072	0.0928	0.6954	0.3046
a. Achaïa	1,294	527	527	174	66					1,171	123		
	%	0.4073	0.4073	0.1345	0.0510	0.2640	0.0975	0.6385	+0.09	0.9049	0.0951	0.6916	0.3084
b. Elis	1,218	469	492	191	66					1,108	110		
	%	0.3851	0.4039	0.1568	0.0543	0.2644	0.1120	0.6237	+1.01	0.9097	0.0903	0.6995	0.3005
15. Corinthia	408	169	164	55	20					366	42		
	%	0.4142	0.4020	0.1348	0.0490	0.2592	0.0966	0.6443	+0.12	0.8971	0.1029	0.6792	0.3208
16. Laconia	642	299	239	82	22					574	68		
	%	0.4657	0.3723	0.1277	0.0343	0.2301	0.0846	0.6853	+0.72	0.8941	0.1059	0.6746	0.3254
17. Messenia	1,114	489	424	140	61					1,026	88		
	%	0.4390	0.3806	0.1257	0.0548	0.2478	0.0944	0.6578	−1.48	0.9210	0.0790	0.7189	0.2811
18. Crete	1,963	761	878	221	103					1,779	184		
	%	0.3877	0.4473	0.1126	0.0525	0.2925	0.0862	0.6214	−0.51	0.9063	0.0937	0.6938	0.3062
a. Canea region	585	212	250	83	40					529	56		
	%	0.3624	0.4274	0.1419	0.0684	0.2894	0.1112	0.5994	−0.48	0.9043	0.0957	0.6916	0.3094
b. Rethymno region	270	98	124	30	18					259	11		
	%	0.3630	0.4593	0.1111	0.0667	0.3104	0.0929	0.5967	−0.78	0.9592	0.0408	0.7980	0.2020

Table 2 (*continued*).

Region	Number of subjects	O	A	B	AB	p	q	r	D/σ[a]	Rh(D)+	Rh(D)−	D	d
c. Herakleion region	835	342	381	79	33					743	92		
	%	0.4096	0.4563	0.0946	0.0395	0.2900	0.0695	0.6405	+0.14	0.8898	0.1102	0.6680	0.3320
d. Lasithi region	273	109	123	29	12					248	25		
	%	0.3993	0.4506	0.1062	0.0440	0.2892	0.0782	0.6327	+0.12	0.9084	0.0916	0.6973	0.3027
19. Samothrace, Thasos	90	41	31	13	5					84	6		
	%	0.4556	0.3444	0.1444	0.0556	0.2247	0.1053	0.6700	−0.43	0.9333	0.0667	0.7417	0.2583
20. Lemnos	102	41	39	18	4					90	12		
	%	0.4020	0.3824	0.1765	0.0392	0.2409	0.1151	0.6440	+0.85	0.8823	0.1177	0.6570	0.3430
21. Lesbos	539	222	228	71	18					483	56		
	%	0.4119	0.4230	0.1317	0.0334	0.2639	0.0867	0.6494	+1.64	0.8961	0.1039	0.6777	0.3223
22. Chios	663	279	290	69	25					599	64		
	%	0.4208	0.4374	0.1041	0.0377	0.2758	0.0737	0.6505	+0.46	0.9035	0.0965	0.6893	0.3107
23. Samos, Icaria	309	121	130	41	17					275	34		
	%	0.3916	0.4207	0.1327	0.0550	0.2759	0.0987	0.6255	−0.05	0.8900	0.1100	0.6683	0.3317
a. Samos	230	86	99	33	12					205	25		
	%	0.3739	0.4304	0.1435	0.0522	0.2814	0.1034	0.6153	+0.47	0.8913	0.1087	0.6703	0.3297
b. Icaria	79	35	31	8	5					70	9		
	%	0.4430	0.3924	0.1013	0.0633	0.2604	0.0854	0.6542	−0.96	0.8861	0.1139	0.6625	0.3375
24. Dodecanese	668	251	294	90	33					625	43		
	%	0.3758	0.4401	0.1347	0.0494	0.2862	0.0970	0.6169	+0.84	0.9356	0.0644	0.7463	0.2537
25. Cyclades[b]	1,073	442	433	144	54					968	105		
	%	0.4119	0.4035	0.1342	0.0503	0.2610	0.0970	0.6421	+0.05	0.9021	0.0979	0.6872	0.3128
a. Tinos	119	61	48	8	2					111	8		
	%	0.5126	0.4034	0.0672	0.0168	0.2388	0.0430	0.7182	+0.32	0.9328	0.0672	0.7407	0.2593
b. Andros	190	58	80	40	12					168	22		
	%	0.3053	0.4211	0.2105	0.0632	0.2843	0.1491	0.5666	+1.32	0.8842	0.1158	0.6597	0.3403
c. Syros	178	83	68	17	10					157	21		
	%	0.4663	0.3820	0.0955	0.0562	0.2489	0.0785	0.6726	−1.38	0.8820	0.1180	0.6565	0.3435
d. Paros	122	53	49	15	5					112	10		
	%	0.4344	0.4016	0.1230	0.0410	0.2537	0.0857	0.6606	+0.16	0.9180	0.0820	0.7137	0.2863
e. Thera	125	61	47	13	4					112	13		
	%	0.4880	0.3760	0.1040	0.0320	0.2306	0.0705	0.6989	+0.04	0.8960	0.1040	0.6775	0.3225
f Melos	74	20	32	16	6					65	9		
	%	0.2703	0.4324	0.2162	0.0811	0.3049	0.1630	0.5321	+0.66	0.8784	0.1216	0.6513	0.3487

Table 2 (*continued*).

Region	Number of subjects	O	A	B	AB	p	q	r	D/σ*	Rh(D)+	Rh(D)−	D	d
g. Naxos	92	45	26	13	8					87	5		
	%	0.4891	0.2826	0.1413	0.0870	0.2032	0.1199	0.6769	−1.96	0.9456	0.0544	0.7669	0.2331
h. Myconos	47	21	21	3	2					43	4		
	%	0.45	0.45	0.06	0.04	0.28	0.05	0.66		0.91	0.09	0.71	0.29
i. Kythnos	31	14	14	3	0					30	1		
	%	0.45	0.45	0.10	0.00	0.26	0.05	0.69		0.97	0.03	0.82	0.18
j. Ios	19	8	8	1	2					18	1		
	%	0.42	0.42	0.05	0.11	0.31	0.08	0.61		0.95	0.05	0.77	0.23
k. Kimolos	23	8	12	3	0					23	0		
	%	0.35	0.52	0.13	0.00	0.31	0.07	0.62		1.00	0.00	1.00	0.00
l. Sifnos	20	5	8	5	2					14	6		
	%	0.25	0.40	0.25	0.10	0.30	0.20	0.51		0.70	0.30	0.45	0.55
m. Polykandro	11	6	3	2	0					9	2		
	%	0.55	0.27	0.18	0.00	0.15	0.10	0.76		0.82	0.18	0.57	0.43
n. Sikinos	4	4	0	0	0					2	2		
o. Serifos	13	2	11	0	0					13	0		
	%	0.15	0.85			0.61	0.00	0.39		1.00	0.00	1.00	0.00
p. Kea	23	9	13	1	0					20	3		
	%	0.39	0.56	0.4	0.00	0.34	0.02	0.64		0.87	0.13	0.64	0.36
q. Amorgos	14	3	5	4	2					14	0		
	%	0.21	0.36	0.29	0.14	0.21	0.26	0.54		1.00	0.00	1.00	0.00
r. Anafi	2	0	1	1	0					2	0		
26. Sporades	144	52	64	25	3					129	15		
	%	0.3611	0.4444	0.1736	0.0208	0.2725	0.1039	0.6236	+2.27	0.8958	0.1042	0.6773	0.3227
27. Euboea	876	383	338	114	41					785	91		
	%	0.4372	0.3858	0.1301	0.0468	0.2467	0.0927	0.6606	−0.18	0.8961	0.1039	0.6777	0.3223
28. Argosaronicos Islands	286	114	118	41	13					263	23		
	%	0.3986	0.4126	0.1434	0.0455	0.2645	0.0996	0.6359	+0.21	0.9196	0.0804	0.7164	0.2836
29. Ionian Islands	1,518	649	597	190	82					1,364	154		
	%	0.4275	0.3959	0.1252	0.0540	0.2560	0.0938	0.6502	−1.04	0.8986	0.1014	0.6815	0.3185
a. Corfu	619	295	236	64	24					562	57		
	%	0.4766	0.3813	0.1034	0.0388	0.2381	0.0737	0.6882	−0.58	0.9079	0.0921	0.6965	0.3035
b. Cephallonia	365	143	147	52	23					327	38		
	%	0.3918	0.4027	0.1425	0.0630	0.2686	0.1084	0.6230	−0.47	0.8959	0.1041	0.6774	0.3226

Table 2 (*continued*).

Region	Number of subjects	O	A	B	AB	p	q	r	D/σ[a]	Rh(D)+	Rh(D)−	D	d
c. Ithaca	42	17	20	2	3					36	6		
	%	0.4048	0.4762	0.0476	0.0714	0.3239	0.0608	0.6153	−1.11	0.8571	0.1429	0.6220	0.3780
d. Leukas	199	85	72	31	11					182	17		
	%	0.4271	0.3618	0.1558	0.0553	0.2363	0.1117	0.6520	−0.19	0.9146	0.0854	0.7078	0.2922
e. Zante	269	97	114	39	19					235	34		
	%	0.3606	0.4238	0.1450	0.0706	0.2884	0.1141	0.5975	−0.39	0.8736	0.1264	0.6445	0.3555
f. Cerigo	24	12	8	2	2					22	2		
	%	0.50	0.33	0.08	0.08	0.233	0.086	0.682	−1.25	0.92	0.08	0.71	0.29
30. Students from	2,173	891	861	292	129					1,959	214		
Athens University	%	0.4100	0.3962	0.1344	0.0594	0.2628	0.1023	0.6349	−0.47	0.9015	0.0985	0.6862	0.3138
Total	36,610	14,786	14,998	4,944	1,882					32,982	3,628		
	%	0.40388	0.40967	0.13505	0.05141	0.26596	0.09806	0.63598	+0.77	0.90090	0.09910	0.68520	0.31480

[a] The D/σ ratio measures the divergence from panmixia and its direction.
[b] Soldiers and students have been added in the detailed (island-by-island) data from the Cyclades.

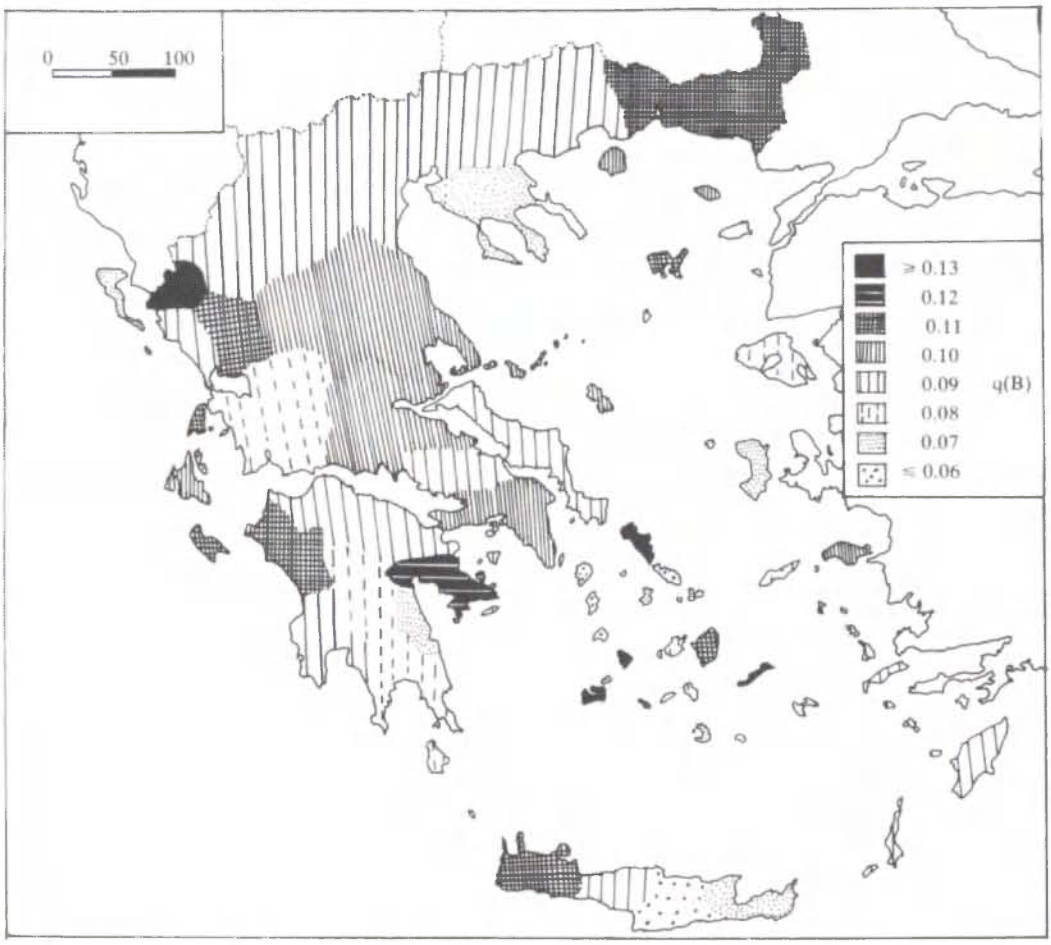

Figure 4. Distribution of the frequency of q(B) in Greece

from Thrace to West Macedonia, from east to west. Thasos and Samothrace have a higher O frequency than Thrace and Macedonia, similar to the pattern shown by Khalkidhiki. Some islands in the Cyclades (Tinos, Thera, Kythnos, and Polykandro) also show a high O and low B frequency (although samples are small for these last two). The data from Roberts et al. (1965) reported in Table 3 corroborate our data on Tinos. Furthermore, Roberts et al. find a higher frequency of O in region V of Tinos, the more remote having the smaller (if any) Catholic or Levantine influence.

On the other hand, high B and sometimes low O frequency are found in Thrace, Filiates, Argolide, Dodecanese, Andros, Melos, and the Canea region. It is known that in the Canea region low O, high B, and high A frequency are due to the Sphakia population (Barnicot et al. 1965, reported in Table 3). The Andros data rather disagree with those of Constantoulis and Paidousis (1958) (Table 3). In spite of some exceptions it also seems that there is generally a negative correlation between allele O frequency and that of B, that there are some high O, low B foci at the periphery of the country or on some islands, and that there is a

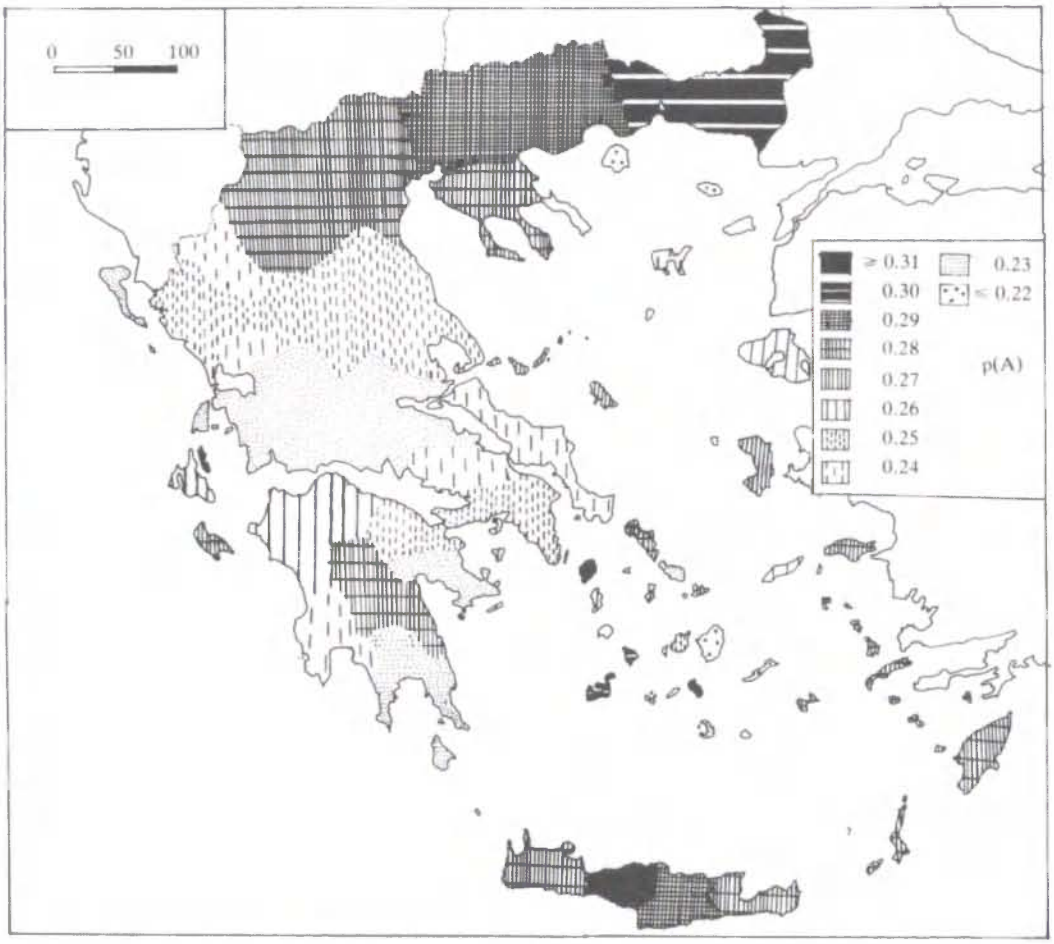

Figure 5. Distribution of the frequency of p(A) in Greece

gradient of decreasing frequency from west to east in the north (Macedonia, Thrace) and on the Dodecanese islands adjacent to Asia Minor.

Other authors' data reported in Table 3 are also significant in their details: Fraser et al. (1969) found an important microdifferentiation between adjacent villages in the Arta district, both of which, however, resemble Aetolia and Acarnania of our sample, rather than Arta. They are situated in the north of the high O focus detected by us. It seems also that the mountainous (and probably more isolated) villages of Corfu have an even higher O frequency than the nearby lowlands, as found by Stamatoyannopoulos and Fessas (1964). Another religiously, linguistically, and geographically isolated population in Thrace, the Pomaks, also show a very high O and low B frequency. Xirotiris (1971) believes that they are remnants of the old Thracians who have changed their language and religion but remained genetically unaltered.

The distribution of the allele A frequency does not show so dramatic a pattern as for O and B. Except for some foci of high frequency in small islands — Ithaca, Kea, Ios, Sifnos, Kimolos, Serifos — there seem to exist

Table 3. Data of the frequencies of ABO alleles from other authors on some small regions of Greece

Region	n[a]	p	q	r	Source
Arta village I	260	0.243	0.109	0.648	Fraser et al. (1969)
Arta village II	353	0.179	0.084	0.737	Fraser et al. (1969)
Corfu, Sokraki village (semimountainous)	133	0.191	0.019	0.790	Stamatoyannopoulos and Fessas (1964)
Corfu, six lowland villages	874	0.2332	0.1103	0.6602	Stamatoyannopoulos and Fessas (1964)
Tinos region I	159	0.240	0.069	0.691	Roberts et al. (1965)
Tinos region II	132	0.250	0.031	0.720	Roberts et al. (1965)
Tinos region III	134	0.280	0.102	0.617	Roberts et al. (1965)
Tinos region IV	114	0.203	0.045	0.753	Roberts et al. (1965)
Tinos region V	148	0.158	0.059	0.784	Roberts et al. (1965)
Sphakia	310	0.372	0.139	0.488	Barnicot et al. (1965)
Herakleion (city)	218	0.273	0.062	0.664	Barnicot et al. (1965)
Pombia village (Herakleion)	208	0.219	0.081	0.682	Barnicot et al. (1965)
Rhodes (Dodecanese)	178	0.296	0.097	0.607	Barnicot et al. (1965)
Kardhitsa (Thessaly)	102	0.242	0.107	0.650	Barnicot et al. (1965)
Atalandi (Phthiotis)	104	0.252	0.085	0.663	Barnicot et al. (1965)
Khalkidhiki (Macedonia)	100	0.274	0.090	0.636	Barnicot et al. (1965)
Andros (Cyclades)	1948	0.2385	0.0977	0.6638	Constantoulis and Paidousis (1958)
Chios	149	0.2057	0.0804	0.7139	Constantoulis and Paidousis (1958)
Pomaks (five villages in Thrace)	1030	0.2666	0.0676	0.6697	Xirotiris (1971)

[a] n indicates the number of subjects sampled except for the regions of Sphakia, Herakleion (city), and Pombia village (Herakleion), where n indicates the number of genes sampled.

three other very high or relatively high A regions: Thrace and Macedonia, with a gradient going from west to east in increase of A frequency; Arcadia and Kynouria in Peloponnesus; and a third in Crete, Rethymo, displaying the highest frequency. This last focus has an influence felt also in the Dodecanese.

In Table 4 we report our data on A_1A_2BO distribution and in Table 5 similar data from other authors. They show no general pattern since the data are rather restricted. Thrace and Aetolia and Acarnania have a low p_2 value but Peloponnesus and Crete a higher one. Table 6 shows the data for the complete Rhesus blood groups, and Table 7 compares the allele frequencies.

DISCUSSION

The frequencies of the alleles of blood-group genes can change and differentiate in different places for four different reasons: (1) because of

Table 4. A_1A_2BO blood-group frequency data of different regions of Greece

Region	*n*	O	A_1	A_2	B	A_1B	A_2B	p_1	p_2	q	r	χ^2 [a]
Thrace	128	40	56	3	16	10	3	0.3033	0.0340	0.1195	0.5432	5.256
Macedonia	743	275	285	41	97	30	15	0.2418	0.0515	0.1006	0.6062	8.260[b]
Epirus	249	96	82	16	43	7	5	0.1998	0.0551	0.1178	0.6273	4.109
Thessaly	411	163	135	19	65	21	8	0.2121	0.0425	0.1214	0.6240	4.884
Aetolia, Acarnania	102	49	34	4	11	2	2	0.1963	0.0375	0.0764	0.6898	1.563
Boeotia	171	73	58	9	23	6	2	0.2093	0.0418	0.0952	0.6536	1.261
Athens	178	78	60	10	21	6	3	0.2069	0.0474	0.0880	0.6577	4.149
Peloponnesus	520	213	184	41	56	18	8	0.2181	0.0628	0.0821	0.6370	2.151
Crete	125	49	47	10	12	6	1	0.2409	0.0598	0.0788	0.6204	0.319

[a] Chi-square (2 d.f.) tests departure from panmixia.
[b] This is the only statistically significant value.

Table 5. Data for A_1A_2BO blood-group frequencies from Barnicot et al. (1965) (details as in Tables 3 and 4)

Region	p_1	p_2	q	r	*n*
Sphakia (Crete)	0.260	0.112	0.139	0.488	310[a]
Herakleion (city) (Crete)	0.204	0.069	0.062	0.664	218[a]
Pombia (Crete)	0.197	0.040	0.081	0.682	208[a]
Rhodes (Dodecanese)	0.261	0.035	0.097	0.607	178[b]
Kardhitsa (Thessaly)	0.163	0.079	0.107	0.650	102[b]
Atalandi (Phthiotis)	0.173	0.079	0.085	0.663	104[b]
Khalkidhiki (Macedonia)	0.240	0.034	0.090	0.636	100[b]

[a] Genes.
[b] Subjects.

Table 6. Data for complete Rhesus blood groups. Numbers of subjects of different phenotypes and genotypes are indicated

Phenotype	Probable genotype		Greece	Chios
CCDee	CDe/CDe	(R_1R_1)	1,242	318
CcDEe	CDe/cDE	(R_1R_2)	791	181
ccDEE	cDE/cDE	(R_2R_2)	63	4
CcDee	CDe/cde	(R_1r)	1,525	488
ccDEe	cDE/cde	(R_2r)	283	77
ccDee	cDe/cde	(R_0r)	97	21
CCDEe	CDe/CDE	(R_1R_z)	45	6
CcDEE	cDE/CDE	(R_2R_z)	34	6
CCDEE	CDE/CDE	(R_zR_z)	5	0
Ccee	Cde/cde	(R′r)	37	11
ccEe	cdE/cde	(R″r)	11	4
ccee	cde/cde	(rr)	341	145
ccD^{u}ee	cD^{u}e/cde	(R_0^ur)	10	0
CCee	Cde/Cde	(R′R′)	1	0
CcD^{u}ee	Cde/cD^{u}e	(R′R_0^u)	3	0
CcEe	cdE/Cde	(R″R′)	1	0
Total			4,489	1,261

different selection in different places; (2) due to the influence of genetic drift; (3) because of differential mutation rates; and (4) due to migration or differences in origin. It is obvious that mutation should be excluded since its rate would not permit differentiation between populations in any sensible time period. In spite of the careful search conducted by numerous authors we still lack a reasonable model based on experimental facts that would explain by selection the maintenance of ABO polymorphism. Either selective forces acted a long time ago and differentiated human populations and then stopped acting up to the present, or this polymorphism is selectively neutral, as Lewontin (1972) has suggested. In both cases it is evident that it is a valuable genetic marker for anthropological studies, that is to say, one can detect the differences in living populations

Table 7. Rhesus allele frequencies calculated from Table 6 data and compared with those from other parts of Greece from different authors

	CDe[a] (R_1)	cDE (R_2)	cDe (R_0)	Cde (R′)	cdE (R″)	CDE (R_z)	cde (r)	cD^{u}e (R_0^u)	n[e]
Greece[b] (present study)	0.540	0.137	0.011	0.005	0.001	0.010	0.295	0.001	8,978
Chios[b] (present study)	0.520	0.108	0.008	0.004	0.002	0.005	0.353	–	2,522
Sphakia (Crete)[c]	0.430	0.148	0.050	0.057	–	–	0.315		310
Herakleion (city) (Crete)[c]	0.591	0.125	0.014	–	–	–	0.270		208
Pombia (Crete)[c]	0.651	0.068	0.083	0.031	0.029	–	0.139		218
Rhodes (city) and Laerma[c]	0.553	0.149	0.016	0.020	–	–	0.262		194
Kardhitsa (Thessaly)[c]	0.482	0.157	0.021	0.013	–	–	0.327		204
Khalkidhiki (Macedonia)[c]	0.527	0.177	–	0.020	–	0.033	0.243		200
Pomaks (Thrace)[d]	0.360	0.090	0.350	0.015	–	0.060	0.125		400

[a] Also includes CD^{u}e and C^{w}De, when present (except for the two first rows).
[b] Present study.
[c] Barnicot et al. (1965).
[d] Xirotiris (1971).
[e] Indicates the number of genes sampled.

and then, with the help of historical data, reconstruct the histories of migrations that gave rise to the actual distribution observed. Drift can still operate in small populations: every village actually consists of a rather restricted and rather isolated population. However, in larger regions, comprising a considerable number of villages, the main frequencies are not expected to change since the process is random. This of course does not hold for small island populations or in the case of bottlenecks in population size in a larger region. We suspect, although other explanations could also account for it in an equally satisfactory way, that a part of the microdifferentiation in the Cyclades, especially for the smaller islands and for Ithaca, could be due to this effect. Bottlenecks have not been observed in recent generations for which full demographic data are available. Ancient demography of Greece is known only in an unsatisfactory and fragmentary way and thus cannot help us. Furthermore, the consequences of drift that took place a long time ago would be to create differences in populations that could also be used as an anthropological tool.

Bearing this in mind, we can make some tentative suggestions to explain ABO pattern distribution in Greece. Christians and Moslems are not different in Thrace: it is known that Turkish invaders in Asia Minor during the end of the Middle Ages were few in comparison to the Hellenized Asia Minor and Thracian populations. The greater contribution to the increase of Moslem populations in these regions as well as in Crete and in Greece was by defectors who changed their religion. This of course does not mean that they also changed their genetic constitution. Before and after the year 1922 a considerable number of Greek Christian refugees from East Thrace, Asia Minor, Pontus, Constantinople, Bulgaria, Russia, and other areas (about 1,200,000 in all) emigrated to Greece (Pallis 1928; Krimbas 1928). Of these, 750,000 settled in Macedonia and Thrace. It seems that 30 percent of the population of Thrace and 25 percent of that of Macedonia were, in 1928, of immigrant origin. In the remaining parts of Greece these percentages were very low. It is difficult now, more than one generation later, to distinguish the autochtonous and immigrant populations. Does the population of Greek Macedonia tend to resemble that of Thrace because of these immigrants? Or did ancient Macedonians differ from southern Greeks? What has been the Slavic influence? These questions remain unanswered, since we still lack reliable information on the immigrants. The data of Constantoulis and Paidoussis (1958) on Asia Minor immigrants, unfortunately from a rather selected sample, show that they should be more like those of Thrace. The general tendency to remark peripherally high O and low B foci (Aetolia and Acarnania, Corfu, southern Peloponnesus, Khalkidhiki, Thassos and Samothrace) fits well with the general picture of ABO distribution in Europe depicted in the tables and maps of Mourant

et al. (1958). It has been suggested that they are the relics of the older populations pushed to the edges of the continent by German, Slav, and Mongol invaders.

One of the invasions of Greece, the Albanian, is well documented: it started in the fourteenth century A.D. (Heurtley et al. 1967: map on p. 118; Vacalopoulos 1974: map on p. 31; Poulos 1950). Albanians have been spreading from Illyria, via Epirus and Thessaly, south to Attica, Boeotia, southern Euboea, Andros, Argolide, Corinthia, the Argosaronicos Islands, and elsewhere. It is significant that they were exterminated or chased from Aetolia and Acarnania by Charles Tokko in the year A.D. 1418. It can be remarked that Filiates, Argolide, and Andros are places with high B, low O frequency.

Much less can be said on Slavic influences. Either they were few or else time has erased by admixture nearly all traces. The high A frequency of Arcadia, a place with the greatest number of Slavic-origin toponyms, according to Vasmer (1941): is it a remnant trace of these old invasions? Greece's history is much more complicated than England's. In England, ABO distribution could be satisfactorily explained by four migrational events. In Greece it is not surprising that internal migrations, during the Ottoman conquest and earlier, drastically altered the picture of ABO distribution. Detailed historical and demographic data would be needed for a sound explanation of the data observed.

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The Distribution of Color Blindness Among Greeks

THEODOROS PITSIOS

We have examined the geographical distribution of color blindness in Greece on the basis of information provided by Poulianos (1968) regarding two anthropological types of the southern branch of the European race. The first of these, the Aegean, extends over the eastern Greek and Aegean islands and the west coast of Greece in the Ionian Islands. The second, the Epirotic type, extends along the Pindus Mountains.

In a third group of "mixed" types, we included people from the two different provinces and a small number of Latin-speaking people (Vlachi). Finally, we have made a separate study of a group of Sarakatsani from Boeotia.

METHOD

In our survey we used only a rapid screening test with the Ishihara plates (Ishihara 1963). We collected our material during 1972, mainly in the district of Attikis and Epiros, though a number were examined from Prastio in Mani. The characteristic stability of this group permitted us to examine persons between the ages of eight and seventy-five, although the great majority were students between the ages of fourteen and nineteen. We filled out a blank for each person examined with personal data, emphasizing the origin of both parents as far back as possible. We checked all the answers of those tested on the blank. We excluded from tabulation the cases of relatives with color blindness, as well as those who knew nothing about their origins for at least two generations back.

At the same time we examined the eye color, using Bounak's scale. Thus we obtained an additional criterion relating to our groups which we separated according to Poulianos' material.

RESULTS

Our results are shown in Tables 1 and 2. What we considered especially was the difference of the two anthropological types so that the possible loss in percentage of color blindness by the use of Ishihara's plates (Adam et al. 1970) would not influence our results. However, the total, 7.2 percent, for the group studied in Greece tallies with the percentage found among Europeans (Adam et al. 1970). On the other hand, we found a real difference between the Aegean (7.27 percent, the P/D = 0.2) and the Epirotic (3.23 percent, the P/D = 0.5) types. This difference is statistically significant, adding up to a 3 "6" deviation. Thus we confirmed the division of the two types.

The whole investigation was carried out under the guidance and the instructions of Professor Aris Poulianos, with the cooperation of L. Boboti and A. Siphneos, members of the Greek Anthropological Society.

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Table 1. Color blindness among Aegean, Epirotic, Sarakatsani, and mixed groups and the Greek population in total

		Red–green deficiencies				Undiagnosed	Total
	Number tested	Protan strong	Protan mild	Deutan strong	Deutan mild		
Aegean groups							
males	522	6	1	21	5	5	
total		7		26			38
percent		1.34		4.98		0.95	7.27
females	548				1		
total				1			1
percent				0.18			0.18
Epirotic groups							
males	588	5	2	8	4	–	
total		7		12			19
percent		1.19		2.04			3.23
females	318		1				
total		1					1
percent		0.31					0.31
Sarakatsani groups							
males	156	5	1	5	3	2	
total		6		8			16
percent		3.84		5.12		1.28	10.25
females	39	-		–		–	–
total							
percent							
Mixed groups							
males	298	5	2	9	20	4	
total		7		29			40
percent		2.34		9.73		1.34	13.42
females	47			1		1	
total							2
percent							4.25
Total Greek population males (n=1,564) and females (n=953)	2,517	21	7	44	33	12	
total		28		77			117
percent		1.11		3.05			4.64
percent males with red–green deficiency P/D=0.36							7.22

Table 2. Eye color among Aegean, Epirotic, Sarakatsani, and mixed groups and the Greek population in total

	Number tested	1–4		5–8		9–12	
		no.	%	no.	%	no.	%
Aegean groups							
males (*n* 493)	493	284	57.60	203	41.17	6	1.21
females (*n* 504)	504	289	57.34	211	41.86	4	0.79
Epirotic groups							
males (*n* 577)	577	375	64.98	193	33.44	9	1.55
females (*n* 300)	300	185	61.66	110	36.66	5	1.66
Sarakatsani groups							
males (*n* 156)	156	83	53.20	69	44.23	4	2.56
females (*n* 39)	39	27	69.23	12	30.76	–	
Mixed groups							
males (*n* 301)	301	218	72.42	78	25.91	5	1.66
females (*n* 46)	46	26	56.22	20	43.47	–	
Greek population in total (males and females)	2,416	1,487	61.54	896	37.08	33	1.36

Sarakatsani: The Most Ancient People in Europe

A. N. POULIANOS

The Sarakatsani nomadic shepherds of continental Greece live mainly along the ranges of the Pindus massif. Epirus, Thessaly, Macedonia, and Thrace are the provinces in which they are most numerous. Sarakatsani communities are also found farther north. Their seasonal migrations have led many of them across the border to Bulgaria, Turkey, Albania, and Yugoslavia. They all speak Greek, wherever they live. The Danish scholar Carsten Höeg (1925–1926) has shown that neither phonetically nor in terms of grammatical structure are there traces of foreign elements in the dialect spoken by the Sarakatsani. Further, he writes, the Sarakatsani material culture shows no trace of sedentary origins. On the contrary, it follows with precision and simplicity from the conditions of transhumant life in a particular physical environment.

The Greek ethnographer Angheliki Chatzimichali (1957), who spent a lifetime among them, believes that they are a population group who, in their pastoral way of life, social organization, and art, exemplify certain prototypical elements of Greek culture. She describes, for instance, the similarities between Sarakatsani decorative art and that of the "geometric" style of preclassical Greece. The English researcher J. K. Campbell (1964) arrives at the conclusion that the Sarakatsani "must always have lived in more or less the same conditions and areas as we find them today." They are, indeed, very endogamic, so we may consider them, from the anthropological point of view, an isolate group.

Taking the above into consideration, we undertook the study of the physical anthropology of the Sarakatsani with the aim of using the data acquired in the solution of this specific ethnogenetic problem. At this point it must be emphasized that racial characteristics in no way predetermine the trend of historical events. But it is also true that the

physical type of a people, its area of distribution, and its physical composition always reflect the course of its ethnic history.

MATERIAL AND METHODS

In 1963, invited by the Bulgarian Academy of Sciences, we studied, among others, a group of about 300 adult Sarakatsani of the Balkan Mountains, half men and half women. Some are shown in Plate 1. In the years 1967 and 1968, another group of almost 300 was studied in the Pindus mountain area in Greece. Some are shown in Plate 2, and their huts in Plate 3. Some sixty metrical and morphological traits were examined in each subject, and more than seventy traits were studied in each of about twenty contemporary Sarakatsani skulls from Boeotia. For comparison we used the tables previously published (Poulianos 1968b, 1969a, 1971, and unpublished data), incorporating data from more than 15,000 people from central Asia through the Caucasus to Spain. In analyzing the collected material, the usual statistical techniques were applied. Table 1 shows some of the traits considered to be of high taxonomic value for this group.

Table 1. Traits of high taxonomic value for the Sarakatsani

	Pindus area		Balkan area	
	males (n = 201)	females (n = 61)	males (n = 140)	females (n = 150)
Head length (mm)	188.3	178.2	193.7	183.9
Head breadth (mm)	158.6	151.9	154.2	146.6
Cephalic index	84.2	85.2	79.6	79.7
Coefficient of correlation	0.16	0.18	0.24	0.33
Bizygomatic breadth (mm)	145.0	135.3	143.6	133.4
Nose height (mm)	56.0	51.9	55.5	50.4
Nose width (mm)	36.0	32.5	36.1	32.5
Minimum frontal breadth (mm)	109.9	106.2	110.6	106.5
Morphological face height (mm)	121.0	111.5	121.5	111.9
Stature (cm)	166.8	154.1	167.8	151.7
Development of the chest hair (percent of fourth and fifth degrees)	22.4	—	15.4	—
Hair color (percent of sixth to eighth degrees in Fisher's scale)	34.3	49.2	21.4	18.6
Brown eye color (percent of first to fourth in Bunak's scale)	40.3	45.9	45.0	62.2
Mixed eye color (percent of fifth to eighth in Bunak's scale)	53.7	52.5	49.9	35.8
Straight nose form (percent)	57.7	62.3	46.4	58.9
Opisthocheilia (percent)	64.2	57.4	61.4	58.3
Straight frontal slope (percent)	59.7	88.5	55.0	96.0
Flat inion (percent)	24.4	32.8	3.6	2.6

Plate 1. Sarakatsani of the Balkan Mountains

ANALYSIS

Upon examination of the data presented in Table 1, it is apparent that the groups share a common origin not only historically, ethnographically, and linguistically, but also anthropologically. Some differences undoubtedly result from the fact that the group from the Balkan area has been separated from the main group from western Greece for about 150 years. Besides, its population is very small, not exceeding 4,000 people. The population of the Pindus area, on the other hand, numbers in the tens of thousands. Thus the Balkan group must be considered even more isolated than that from the Greek mainland.

Both groups are characterized by large cephalic diameters, but the largest of all, in comparison to other Europoid series, is the bizygomatic breadth, equaling that of the Mongoloids. The Boeotian skulls give us the same picture. There is of course nothing of the Mongoloid complexity among Sarakatsani. Their large bizygomatic diameter in a very few cases actually exceeds the cephalic breadth. This, according to Coon (1954), is an archaic trait found only among Upper Palaeolithic Europeans. Wide

Plate 2. Sarakatsani of the Pindus Mountains

Plate 3. Sarakatsani huts in Epirus

zygomatic arches sometimes combine with flaring gonial angles, and often the forehead is wider than the mandible; the face thus takes on the characteristic form of an inverted triangle.

The morphological face height is quite small in relation to the face width, a trait also very distinctive for the Epirotics, as all the above are for the Aegeans (Mediterraneans).

The female groups also show a low face height. The plump cheeks of the Sarakatsani stand at the opposite European extreme from the drawn ones of the Aegeans. Brow ridges are of moderate size or nonexistent. In most cases the frontal slope is straight. The skin color is also lighter among Sarakatsani, and chest hirsuteness is rare. Hairiness in this part of the world seems to be a trait of great taxonomic value. The lack of any prognathism is stressed by the high percentage of the opisthochelic part of the face. These are only some of the traits.

DISCUSSION

The description given above places the Sarakatsani population in the Continental, or Epirotic, type of the Europoids, and not among the Mediterraneans (Necrasova and Boev 1962). It has been shown that the Epirotic type is much older on European soil than the Mediterranean (Poulianos 1968a). It is closely related to the "Brünn–Przedmost–Cro-Magnon" type described by Debetz (1936). This same type is followed up by Gokhman (1966) among the Mesolithic (Vassilievka III) and Neolithic populations of the Ukraine. Due to this work by Gohman we now know that the "Cro-Magnon" (in the widest meaning of the word) anthropolog-

ical type in western Europe during the Upper Palaeolithic is the same in eastern Europe and on the steppes of the Russian plain.

Upper Palaeolithic skulls are not yet known in Greece, but a very interesting find has been made of early Mesolithic (Jacobsen 1969). The physical type of the skull is classified by Angel (1969) as Basic White (A_3) and lies between Téviec and Natufians (less linear than the latter). Our own study of the skull (Poulianos 1970) revealed a face that is low (68 mm) and quite wide (143 mm). The frontal width is rather small and the slope almost straight. Unfortunately we have, so far, only one skull, and it would be difficult to draw general conclusions about the Mesolithic population of Greece from it. Still, we can classify it among the proto-Europoids, linking, anthropologically, the territories of central and southern Europe at a very early period.

The Epirotic type described above is met not only in the Pindus massif but also among the Epirotes of northwestern Greece, whom we first studied in 1957, and after whom the type was named. The same type is met in Montenegro (described by Ehrich 1948), in northwestern Bulgaria (Poulianos 1966), in Romania (Milcu and Dumitrescu 1958, 1961), in the Ukraine (Diatchenko 1965). It is not confined to the Dinaric Alps but extends to the west at least as far as Switzerland. It is really Epirotic (e.g. continental). The Upper Palaeolithic Europeans could not vanish without a trace. Their descendants became the Epirotics, and the most representative group of them, the nucleus, so to speak, of the Epirotic type, are the Sarakatsani isolates.

Up to now the opinion has prevailed in the literature that the Basques, who do not speak an Indo-European language, were possibly the oldest people in Europe. Some refer to the Lapps as well. Let us consider both cases: the Basques (Poulianos 1969b) as a whole are not very different in physique from the rest of the population of Spain, which in its absolute majority is Mediterranoid. This is not to say that no Cro-Magnon elements are found among the Basques, any more than we can say that no Mediterranoids are found among the Sarakatsani. The relict language is only an indication of the antiquity of a population. The physical features are what count. From our data the Sarakatsani are shown to be much older.

The Lapps of the north of Scandinavia are no longer an anthropological enigma. The traditional point of view, to seek among Lapps the ancient brachycephalics of Europe, no longer has any foundation. Many anthropologists who have worked among them have shown that the Lapps are the result of cross-breeding with Mongoloids, who came to Europe (Bunak 1956) much later, after the Europoids already existed there. Thus the Lapps cannot be the oldest people of Europe either.

The geographic differentiation of traits described above for the Epirotics

shows that they have persisted in their special geographic regions and are met in a more "compacted" form among the Sarakatsani of the Pindus and Balkan mountain areas, despite other changes of a more clearly phyletic evolutionary nature. Thus the antiquity of the Sarakatsani type is, at least, indirectly, established. The Sarakatsani are nothing more nor less than a local Upper Palaeolithic survival or, perhaps, a reemergence. Being an ecologically isolated group, they are a local specialization, in which selection may have played a part, along with other possible factors associated with life in a mountainous area. Looking into the historical past of races on our continent, the Sarakatsani may be considered the most ancient population of Europe.

The data presented here once more verify the validity of the thesis held by Oshinsky (1959) and Krogman (1964), that anthropometric and morphological traits must still be considered the nucleus of physical anthropology.

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New Anthropological Materials on the Problem of the Ethnogenesis of the Byelorussian People

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In recent years, a group of anthropologists at the Institute of Ethnography, Arts and Folklore Studies of the Academy of Sciences of the Byelorussian SSR has carried out a program of anthropological studies of the Byelorussians.[1]

The craniological material of the eighteenth and nineteenth centuries is represented by a series of 192 adult skulls (ninety-three males and ninety-nine females) excavated from rural burial grounds on the main territory of Byelorussia (except the Polesye area). The medieval population of Byelorussia is represented by a series from the eleventh and twelfth centuries taken from the territory around the town of Novogroudok of the Grodno region, forty-five skulls in all (thirty males and fifteen females).

Analysis of the series from the Byelorussian burial grounds of the eighteenth and nineteenth centuries showed their essential similarity in terms of all craniological characteristics; accordingly, they were all classified under a single anthropological type and came under a common Byelorussian series, shown in Table 1.

All the series represent one of the variants of the major Europoid race, yet feature a peculiarity: a moderately protruding medium-wide nose with a somewhat lowered nose bridge, combined with a pronounced horizontal profiling of the face insignificantly flattened in its upper part.

In order to trace back the process of formation of the anthropological type of the Byelorussian people, we have compared the craniological series of the eighteenth and nineteenth centuries with the literary data on

[1] Salivon collected and processed new paleoanthropological material; Tegako was responsible for the odontology and dermatoglyphics of the Byelorussians; Mikulich studied the ABO, MN, and $Rh_o(D)$ blood group systems, PTC sensitivity, and color blindness.

Table 1. Mean cranial dimensions of the population of Byelorussia, second millennium A.D.

Characteristic	Eighteenth and nineteenth centuries						Eleventh and twelfth centuries					
	men			women			men			women		
	n	M	σ	*n*	M	σ	*n*	M	σ	*n*	M	σ
1. Maximum cranial length	90	176.0	6.8	92	168.7	6.3	29	188.5	6.3	12	178.5	8.1
8. Maximum cranial breadth	90	143.3	4.9	95	137.3	4.8	26	140.1	6.0	11	135.2	4.1
8:1. Cranial index	90	81.8	3.6	91	81.4	4.1	26	74.3	4.1	11	75.5	3.6
9. Minimum frontal breadth	88	97.0	4.4	95	93.1	4.1	29	99.2	4.5	14	93.7	4.9
17. Height diameter from basion	82	131.7	6.2	85	125.3	4.9	23	138.1	4.5	9	130.3	7.0
32. Frontal angle from nasion	89	84.7	4.7	95	83.4	4.4	15	81.9	4.6	7	87.7	2.5
45. Bizygomatic breadth	84	132.1	4.8	85	123.3	4.4	22	132.5	7.6	11	124.1	8.3
48. Upper face height	77	68.5	4.9	89	66.0	4.3	23	70.6	2.8	12	66.0	4.2
48:45. Upper facial index	72	52.3	3.4	76	53.2	3.3	20	53.3	2.6	11	54.0	4.3
51. Orbital breadth (from mf. left)	89	40.4	2.2	98	39.0	2.1	26	41.5	1.5	13	39.4	2.0
52. Orbital height (left)	88	31.6	2.3	98	31.4	2.0	28	31.8	2.0	13	31.7	2.3
54. Nasal breadth	88	25.4	1.9	97	24.3	1.6	26	25.4	1.6	13	24.2	2.5
55. Nasal height	86	49.7	3.1	97	47.8	2.7	25	52.5	2.6	12	48.0	0.8
Symotic height	82	4.5	1.2	91	4.0	0.9	20	4.8	0.98	11	4.1	0.97
Symotic index	82	49.1	14.3	93	45.1	9.7	20	48.8	9.5	11	45.1	4.7
Dacryal height	81	12.9	1.4	90	11.7	1.6	17	14.9	0.9	9	12.1	1.7
Dacryal index	81	58.3	8.7	90	56.2	7.2	18	65.2	13.3	9	60.1	10.6
72. Total facial angle	77	85.6	2.5	83	83.9	3.1	12	84.2	3.9	7	84.6	2.3
75. Nose protrusion angle	68	127.7	5.2	75	24.3	5.2	12	28.3	4.0	7	25.9	4.9
77. Naso-malar angle	90	138.5	5.7	94	138.8	4.6	28	137.6	5.2	15	137.4	6.0
Zygo-maxillar angle	76	127.0	6.1	86	126.6	5.8	15	125.5	5.3	12	126.3	5.7

the medieval (eleventh through thirteenth centuries) craniological series from the territory of Byelorussia, which are classified by tribes and which represent the sole paleoanthropological material to date.

In our work we have allowed for the inevitable population migrations in various historical periods and for epochal changes, in consequence of which one can hardly expect chronologically spaced series to fully coincide with anthropological type.

In the past millennium, the most pronounced anthropological changes over the territory of Byelorussia have occurred with the cranium: the longitudinal and height dimensions as well as the length of the skull base have diminished, while the maximum cranial breadth and the minimum frontal breadth have increased somewhat; the cranial index has likewise increased.

The pronounced round-headedness of the present-day population of Byelorussia may, in all probability, be accounted for by the epochal changes which have taken place practically everywhere in eastern Europe in the last millennium and which have manifested themselves in brachycephalization. At the same time, the epochal changes which manifested themselves in gracilization of the facial skeleton have had little or no impact on our population, which is to say that the structure of the facial skeleton has remained all but unchanged.

We have noted features of continuity of the anthropological type in the populations of the eleventh through thirteenth and eighteenth through nineteenth centuries. The absence of any clearly defined tribal differences in the anthropological type of the medieval population was apparently a major factor behind the marked anthropological homogeneity of the Byelorussian population in the eighteenth and nineteenth centuries.

A specific complex of features characterized by a slightly attenuated Europoid type in the nose-protrusion angle combined with manifestly Europoid values of the dacryal and symotic heights, as well as by similar nose-bridge protrusion indices and horizontal face profiling angles, is noted on the territory of Byelorussia both in the medieval series and in the series of the eighteenth and nineteenth centuries. A similar complex of characteristics was widespread in the Middle Ages, so that it could be found in both the Finnish-speaking Baltic peoples and the peoples of the Volga–Oka interfluvial, as well as in the East Slavonic population (all groups of the Krivichi, Vyatichi, Novgorod Slovens, Dregovichi, and Radimichi). Our predecessors connect the mentioned complex with a manifestation of a pre-Slavonic Finnish or East Baltic substratum assimilated by the Slavs settling over the territory of eastern Europe.

According to craniological characteristics the Byelorussian series of the eighteenth and nineteenth centuries are closest to the Russians and Ukrainians. This fact is historically explained by the formation of three eastern-Slavonic peoples from an ancient Russian people, the descen-

dants of the medieval population whose tribal groups had exhibited considerable similarity in anthropological type. Nevertheless, the specific complex of somewhat attenuated Europoid features has been preserved from the Middle Ages until today in a practically unaltered form among eastern-European peoples only in Byelorussia. The Soviet anthropologists V. P. Alexeyev and T. I. Alexeyeva have observed a marked strengthening of Europoid features among Ukrainians and particularly Russians from the adjoining territories, which process has been particularly pronounced in the past few centuries of the present millennium. This fact seems to attest to the considerable contribution of the ancient local (pre-Slavonic) population to the formation of the Byelorussian anthropological type. This conclusion is also borne out, we believe, by the almost total invariability of the bizygomatic breadth and face height over the last millennium, suggesting the preponderance of wide- and low-faced elements in the formation of the Byelorussian anthropological type. These elements are traced by Soviet anthropologists to the area of the Baltic. Another fact which might be considered as additional evidence in favor of this conclusion is the similarity of the mentioned specific complex of somewhat attenuated Europoid features among the Byelorussians of the eighteenth and nineteenth centuries with the corresponding complex of the population of the same period from the eastern regions of Lithuania, Latvia, and Estonia, and also of the Russians from the western regions adjoining Byelorussia. The results of somatological surveys led our predecessors to include the population of these territories in a single East Baltic type of the Europoid race.

For dermatoglyphic indices, 2,436 persons (1,247 males and 1,189 females) were examined; for odontological characteristics, 1,134 persons (660 males and 474 females). Results are shown in Tables 2 and 3. Territorially, the groups covered by the survey are distributed as follows:

1. Byelorussian groups:
   a. Vitebsk region;
   b. eastern Polesye;
   c. western Polesye;
   d. Minsk region;
   e. Moghilyov region;
2. Letts;
3. Lithuanians;
4. Poles;
5. Russians;
6. Tartars.[2]

[2] The Letts were examined in the town of Ghulbene, Latvian SSR; the Lithuanians, in the towns of Anikishchai and Shirvintas, Lithuanian SSR; the Poles, in the town of Sopotskin, Grodno region, Byelorussian SSR; and Eishishkes, Lithuanian SSR. The Tartars settled in Byelorussia, Lithuania, and Poland in the fourteenth and fifteenth centuries. Prince Vitovt

The material of the investigation was statistically analyzed for two purposes, to determine (1) the differences as revealed by the characteristics studied and the statistical significance of these differences (by Student's method); and (2) the racial diagnostic value of the dermatoglyphic and odontological characters (by the χ^2 technique).

The distribution of the dermatoglyphic and odontological characteristics in all the groups studied (with the exception of the Tartars) falls within the range of variations characteristic of the Europoid peoples, as shown in Tables 2 and 3. The dermatoglyphic characteristics chosen for the racial analysis (the delta index, the Cummings index, the number of deltaless and one-delta patterns per Hy and the percentage of the carpal triradius t) and also the odontological characteristics (the shovel-shaped incisors, the percentage of the Carabelli cusp, etc.) exhibit a peculiar complex for all Byelorussian territorial groups except the population of western Polesye, whose deviations from the mean Byelorussian group are the greatest and show a tendency toward relatively pure Europoid features.

Byelorussian subjects numbering 3,298 (1,466 males and 1,832 females) and 833 representatives of the other five ethnic groups have been studied for the frequency of the genes of the determinant blood groups ABO, MN and $Rh_o(D)$, palatal sensitivity to PTC, and color blindness. Results are shown in Table 4. The regions of anthropological expeditions and often the exact localities of field "scoopings" were determined in advance. In order that the group mean deviations be minimized, at each point of sampling we tried to examine not less than fifteen to twenty persons. The found concentrations of alleles permitted comparison of territorial and ethnic groups under study for their degree of genetic affinity. The analysis was based on the main precepts of population and genogeographic techniques.

Homogeneous and somewhat more heterogeneous zones were delineated by the intensity of variation of each index. The variations in the concentrations of the genes of all the systems under study were found to be independent of one another, but the genes determining the B(III) blood group, color blindness, and PTC sensitivity fell into a certain geographical pattern. With reference to blood-group systems ABO, MN, and $Rh_o(D)$ and to color blindness at the level of regional groups, all the population groups examined differ from one another statistically uncertainly. Using the sum of all eleven alleles, however, we found local polymorphism at a statistically significant level in the Brest and Pinsk groups on the one hand ($\chi^2 = 32.77$ and 19.67 respectively at df = 10),

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settled invited Tartar troops, prisoners-of-war, and political refugees to strengthen the frontiers of the Great Duchy of Lithuania which comprised, among other areas, Byelorussia. Our survey included the Tartars living in the Minsk and Brest regions of the republic.

Table 2. Dermatoglyphic characteristics of ethnic groups (percentage)

Ethnic group	*n*	A + T	L + L	W	Dl_{10}	Cummings index	*t*	*t'*	y	Tn/I	II	III	IV
Byelorussians:													
1. Vitebsk region	160	9.0	54.3	36.7	12.77	8.79	65.7	19.4	33.7	5.3	6.3	34.6	44.7
2. Eastern Polesye	177	9.4	58.5	32.1	12.27	8.70	58.0	21.4	34.5	6.5	6.5	33.3	46.6
3. Western Polesye	348	9.6	62.8	27.6	11.80	8.69	59.2	19.2	35.1	10.0	3.0	43.9	49.2
4. Minsk region	190	8.8	56.4	34.8	12.60	8.41	61.6	24.5	31.0	5.5	4.7	45.3	52.3
5. Moghilyov region	190	9.3	58.2	32.5	12.32	8.69	66.3	13.2	36.6	3.9	3.9	41.8	41.0
Byelorussians *in toto*	1,065	9.3	58.7	32.0	12.27	8.64	61.5	19.5	34.5	6.9	4.3	40.6	47.3
Letts	96	7.9	58.8	33.3	12.54	8.51	62.5	19.3	29.0	9.9	3.6	45.3	48.9
Lithuanians	305	7.6	60.5	31.9	12.43	8.70	61.2	22.5	32.5	8.7	4.1	44.3	49.7
Poles	235	9.2	54.4	36.4	12.72	8.27	65.5	17.0	31.5	9.0	3.8	43.2	47.2
Russians	210	5.0	59.6	35.4	13.04	8.74	64.0	18.4	26.9	9.3	3.6	41.4	46.2
Tartars	95	6.6	51.7	41.7	13.51	8.58	64.9	18.9	30.0	9.4	7.3	39.5	51.1

Table 3. Odontological characteristics of ethnic groups (percentages)

Ethnic group	*n*	Shovel-shaped incisors		Carabelli cusp occurrence of forms	Caries	
		J^{I} form 2 + 3	J^{II} form 2 + 3	2 + 3 + 4 + 5	maxilla	mandible
Byelorussians:						
1. Vitebsk region	51	15.6	13.7	40.9	17.6	33.4
2. Eastern Polesye	123	13.8	19.2	21.3	24.4	43.9
3. Western Polesye	231	5.7	13.0	54.5	34.6	51.1
4. Minsk region	104	10.6	26.0	45.1	36.5	52.9
5. Moghilyov region	90	11.1	28.8	34.0	55.0	66.0
Byelorussians *in toto*	599	9.8	19.1	41.3	34.3	50.6
Letts	90	2.2	7.7	43.6	62.0	79.1
Lithuanians	246	15.0	30.7	26.8	34.0	60.0
Poles	104	15.1	21.5	33.8	21.0	48.6
Russians	204	12.2	31.4	38.7	42.4	59.5
Tartars	91	22.0	21.1	25.0	33.0	45.0

and in the Gomel group on the other ($\chi^2 = 18.4$). The Vitebsk group, because of its local variability, only approximates the level of statistical significance ($\chi^2 = 16.54$). In other words these groups differ from the mean Byelorussian population. The other territorial and ethnic groups studied represent, in all likelihood, a consolidated genetico-anthropological type. However, a direct comparison of the morphological and serological features shows no marked geographic agreement.

The analytical possibilities offered by population genetics enable us to eliminate the taxonomic nonequivalence of the factors. Using Steinberg's generalized-distance formula, we first analyzed the distance variation in each of the monolocus genetic systems. Then the generalized distances were calculated for all the genetic systems studied, the groups taken in pairs. The values of the generalized distances thus obtained were taken as a measure of similarity between the groups of examined individuals, as shown in Table 5. Studying this data, one is immediately struck by the considerable genetic difference of the Brest and Pinsk Byelorussians and the Byelorussian–Russian half-breeds from the other groups. The Gomel and Vitebsk groups are somewhat less genetically different from the population means.

Thus, the serological, dermatoglyphic, odontological, and other genetically determined characteristics indicate that the values of these characteristics in the groups examined in Byelorussia and adjoining areas vary within a range characteristic of the western racial branch.

The population of western Polesye, with its marked shift toward Europoid features, stands apart with regard to the above characteristics. A comparison of the anthropological material with archeological and

Table 4. Frequency of the genes of blood systems ABO, MN, Rh_o (D); sensitivity to PTC; color blindness; gene equilibrium by ABO and MN; and group heterogeneity

Territorial or ethnic group	*n*	System ABO				System MN		Occurrence of Rh_o(D) gene	Occurrence of t gene (PTC)	Occurrence of blindness gene	Intergroup heterogeneity
		O	A	B							
Pinsk	300	60.13	23.57	16.30	0.031	58.49	13.308[c]	37.42	67.07	17.48	19.67[a]
Brest	288	56.18	27.68	16.13	1.987	63.20	10.331[c]	37.74	68.15	20.65	32.77[b]
Grodno	141	63.90	21.09	15.01	0.145	61.78	0.303	36.84	59.81	13.08	4.43
Baranovichi	371	60.40	25.94	13.66	1.154	60.79	0.182	41.27	62.46	12.26	6.09
Molodechno	146	57.13	29.03	13.84	0.059	57.88	1.752	37.27	61.42	10.18	3.61
Polotsk	206	61.30	24.79	13.91	0.048	59.23	0.049	38.25	52.57	8.60	11.48
Vitebsk	302	59.42	27.71	12.86	2.825	59.79	1.153	41.23	51.98	14.76	16.54
Minsk	261	64.01	22.06	13.93	0.268	55.37	0.000	39.71	57.04	13.67	8.73
Bobruisk	236	60.91	22.63	16.45	3.485	60.04	0.204	40.74	60.37	17.15	4.66
Moghilyov	431	57.50	26.16	16.33	9.534[b]	61.49	1.520	36.85	56.54	12.03	8.38
Gomel	287	60.36	24.81	14.83	0.265	56.82	0.167	46.42	53.14	15.08	18.40[a]
Mozyr	330	54.49	27.57	14.99	1.670	56.82	2.164	38.44	–	14.22	3.63
Byelorussians *in toto*	3,294	60.48	25.07	14.45	3.630	59.39	3.085	39.59	59.67	14.41	138.39
Grodno Poles	148	61.77	23.53	14.69	1.547	60.13	1.440	44.26	61.24	11.89	4.59
Byelorussian–Russian half-breeds	188	54.91	26.01	19.06	3.991[a]	57.49	0.290	38.00	59.58	4.09	14.16
Russians	235	56.47	28.57	14.95	0.269	59.35	0.001	36.09	58.79	12.18	5.29
Lithuanians	206	61.07	21.42	17.51	0.230	54.08	3.284	40.10	56.48	8.94	11.08
Lithuanian Poles	106	60.72	26.68	12.60	0.003	66.04	0.110	39.22	52.83	9.67	9.06

[a] Significance at a level of $P = 0.05$.
[b] Significance at a level of $P = 0.01$.
[c] Significance at a level of $P = 0.001$.

Table 5. Generalized distances by eleven genes of five systems of characteristics

Group	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	
Pinsk	7.43	9.31	15.31	14.35	39.07	36.52	18.92	6.77	28.17	35.54	19.74	12.32	46.84	17.33	30.21	338
Brest		18.60	26.50	21.89	55.28	44.61	38.28	14.55	39.67	48.95	30.48	21.40	63.19	25.15	42.89	499
Grodno			5.13	7.06	9.08	11.58	4.61	4.33	5.11	14.28	10.07	4.34	24.56	6.00	9.55	144
Baranovichi				4.27	15.88	17.60	10.89	9.14	11.68	19.67	13.43	1.70	28.57	6.97	16.93	204
Molodechno					7.73	12.60	9.61	12.60	5.55	17.54	6.92	7.69	13.39	1.67	9.54	152
Polotsk						10.79	10.25	21.65	7.82	16.21	21.69	10.10	15.49	9.10	9.47	258
Vitebsk							10.25	13.88	11.81	6.00	19.48	10.98	41.58	9.83	20.72	278
Minsk								7.29	12.69	8.61	13.79	6.05	32.39	10.42	7.67	202
Bobruisk									13.10	11.73	11.25	5.46	39.84	11.51	17.91	201
Moghilyov										21.26	16.07	8.93	23.26	2.39	13.73	221
Gomel											22.83	8.21	42.69	18.88	16.18	309
Mozyr												10.16	32.55	7.48	19.15	255
Grodno Poles													21.47	8.27	8.22	145
Byelorussian–Russian half-breeds														20.94	12.74	459
Russians															13.22	169
Lithuanians																248

linguistic evidence suggests that the peculiar complex of anthropological characteristics found in the Byelorussian population of western Polesye crystallized long ago under conditions of relative isolation. The anthropological type of the rest of Byelorussia seems to have been formed with a large contribution from the local population, genetically close to the population of the eastern-Baltic areas.

Endogamy and Multivariate Distances in the Canary Islands

ILSE SCHWIDETZKY

The degree of endogamy is a measure of reproductive isolation, while multivariate distances between populations are a measure of biological differentiation. As isolation favors local differentiation, a relationship between these two measures could be expected.

This hypothesis has been tested for the Canary Islands. The material consists of 6.814 primary-school pupils from 129 localities on the seven main islands. Anthropometric and anthroposcopic markers were studied using this material. For 11,553 male and female children six to fourteen years old the birth place of the two parents is known.

The degree of endogamy has been calculated as the percentage of children whose parents were born in the same village. It is high for most of the villages in the islands, e.g. in Tenerife the mean degree of endogamy is 66.70 percent (n = 3,170), while it is 50.50 percent in Gran Canaria (n = 3,426). The highest degree of endogamy has been found in Gomera (75.50 percent, n = 1,074) and the lowest in Fuerteventura (39.60 percent, n = 682).

Hiernaux's Δ g is the distance measure calculated for each pair of villages as well as each pair of islands (Hiernaux 1965). The distance measure was based on twenty-one variables: eight absolute measurements (six measurements of the head and face, the stature, and the chest circumference), pigmentation of eyes and hair, the index of pattern intensity of the fingerprints, and ten morphological characteristics of the face, partially measured from photographs (index of lips, chin angle, nose profile, frontality of the cheek bones, etc.) (Schwidetzky 1967). The characteristics varying with age have been standardized (Schwidetzky 1972). As the global range of variability of many of these characteristics is not known, the range of variation of the 129 Canarian localities has been used as a basis of reference.

The correlation between degree of endogamy and multivariate distances has been calculated only for those villages in which at least thirty individuals were studied for all twenty-one variables. Only the two biggest islands had enough localities meeting this criterion, sixteen in Tenerife and fourteen in Gran Canaria.

Five different multivariate distances have been calculated: A for metrical characteristics, B for morphological characteristics of the face, C for pigmentation and pattern intensity, D for A plus C, and E for A plus B plus C. For each of the villages the mean multivariate distance from other villages of the same islands has been calculated. This mean is considered as the measure of local biological differentiation. Then the rank correlation between mean multivariate distance and degree of endogamy of the respective villages was calculated. Results are shown in Table 1.

Table 1. Rank correlation between endogamy rate and mean multivariate distance from the other local populations of the same island

Island	Number of local populations	Multivariate distance A	B	C	D	E
Tenerife	16	+0.532[a]	+0.261	+0.166	+0.603[b]	+0.668[b]
Gran Canaria	14	+0.622[a]	+0.675[b]	+0.109	+0.490[a]	+0.670[b]

[a] Significant at the 5 percent level.
[b] Significant at the 1 percent level.

All correlations are positive, which means the higher the degree of endogamy the higher the degree of biological differentiation of the respective population from populations living in other localities of the same island. Four of the ten correlations are significant at the 1 percent level and three at the 5 percent level. The best results are represented by the total distance E.

The relationship between genetic and geographic distance does not appear to influence this result. Unfortunately, geographic distance between the villages could not be measured on maps because of the rather complicated orography of the islands. However, the slight relation between geographic and multivariate distances is shown in Table 2. This gives the mean distances between the local populations of certain regions (in a diagonal line) and between the regions of Tenerife and Gran Canaria. The mean distance between the villages of the same region is often not much smaller than that between the regions, as would be expected if there were a strong relation between geographic and biological distance. This is true especially for the C distance, which consists of characteristics with the highest heritability (pigmentation and pattern

Table 2. Mean multivariate distances ($\Delta_g C$ and $\Delta_g E$) within and between geographic regions

	$\Delta_g C$						$\Delta_g E$					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI
Tenerife:												
northern mountain villages	1,131						480					
southwestern mountain villages	880	508					657	356				
southeast	694	477	351				737	621	593			
southwest	861	605	537	642			653	473	599	501		
north	910	519	474	452	424		888	763	727	635	394	
Gran Canaria:												
north	719						394					
northeast	551	569					451	382				
northern mountain villages	1,165	1,018	1,115				130	894	929			
east	550	611	1,224	417			586	381	799	242		
west	452	637	1,308	417	212		425	391	1,040	430	396	
southern mountain villages	765	544	1,246	928	968	1,099	942	611	874	547	783	417

intensity). The distances between different localities of the same island do not indicate geographic gradients but present a mosaiclike appearance, especially for the villages in the mountains.

On the other hand, if instead of comparing local populations of the same island, we compare populations of the seven islands, the picture is quite different. In this case the geographic distance could be measured as the lowest distance between coastal points of the two islands respectively. The rank correlation between this geographic distance and the total multivariate distance E is +0.842 (k = 21), which is significant at the 1 percent level. However, there is no correlation between multivariate distance and the rate of endogamy. The mean multivariate distance between islands is also smaller than that between the localities of the same island, which is understandable. The possible explanation is that differences between villages are due to different degrees and patterns of genetic drift which are not reflected in the means of the total island population.

The real breeding populations of the islands are the local populations which are, as has been shown, reproductively rather isolated by the mountainous terrain of most of the islands. Especially in Tenerife and Gran Canaria many deep *barrancos* [mountain gorges] render any form of transport difficult, and even today some villages are not accessible by car. For these local populations the hypothesis has been proved that there is a relation between reproductive isolation and multivariate distance as a measure of biological differentiation.

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Anthropometry of Egyptian Nubians

EUGEN STROUHAL

Egyptian Nubia, a narrow strip of land on the Nile, squeezed from both sides by vast deserts, vanished from the maps as a result of the construction of the Aswan High Dam. Nevertheless, its historical treasures of high value had been saved or precisely documented by an international effort to safeguard Nubian monuments. The picture of the historical development of Nubian archaeological cultures has become more precise in recent publications. Also, human skeletal remains saved from the excavated cemeteries enable us to reconstruct the biological development of Nubian populations over the course of time (Anderson 1968; Strouhal 1968; van Nielsen 1970; Strouhal 1971c; Strouhal and Jungwirth 1971; Green and Armelagos 1972; etc.).

In contrast to all this effort and the gathering of such extensive data, there were until recently only a few contributions dealing with the physical anthropology of the living Egyptian Nubian population. Early anthropometric interest, as shown by Chantre (1904) and Craig (1911), was limited to a few features and remained isolated for a long time. Recently, only Field (1952) has published anthropometric data on population samples from the Sudanese part of Nubia. Measurements and further observations gathered by W. Szwaykowski (personal communication) in Dabod, Egyptian Nubia, and by Mohammad Mitwalli Mousa (personal communication) in Sudanese Nubia have remained unpublished to date. The same applies to the analysis of the cephalograms taken on Egyptian Nubians as described by Harris et al. (1966). Only a contribution on blood groups and hemoglobin variants among Nubians has been made available (Awny et al. 1965).

In order to fill the gap in the knowledge of the physical anthropology of recent Egyptian populations, two joint Arab–Czechoslovak anthropological expeditions, headed by Professor Ali Hassan and Professor J. A.

Valšík, were organized in 1965 and 1967. During this time, Nubians were examined one to three years after their resettlement from Old Nubia, their original country, to New Nubia, a complex of newly built villages in the surroundings of Kom Ombo, Upper Egypt. We gathered records on 1,672 children, 605 men, and 276 women. This sample of 2,553 persons represents 5 percent of the total population of Egyptian Nubia (Valšík et al. 1970a, 1970b; Valšík 1972).

Some preliminary reports on the physical and social anthropology and on the medical, biological, and linguistic aspects of the expedition have already been published (Drobná 1972; Ferák and Pospíšil 1972; Fiedler et al. 1971; Hussien 1971a, 1971b, 1972; Strouhal 1970, 1971a, 1971b, 1972a, 1972b, 1972c, 1973, 1974).

The complete data on males are being prepared for a comprehensive monograph which will be published in the Anthropological Papers of the Náprstek Museum, Prague.

MATERIAL AND METHODS

The present paper deals exclusively with the anthropometry, the body composition, and a few of the physiological features of the three Nubian ethnic groups: the Kenuz, the Nubian Arab, and the Fadidja, who originally lived in Old Nubia in that order from north to south. The analysis was done on samples of men aged twenty-one to fifty-five years and included 103 Kenuz, 115 Arab, and 175 Fadidja. (Note: Kenuz, Arab, and Fadidja are the plural forms.)

These sedentary Nubian ethnic groups were also compared with a rather limited sample of twenty-four adult Ababda, an ethnic group belonging to the Beja tribes who live as nomads in the Eastern desert. These Ababda have only recently become sedentary in their own small hamlets in the southern part of the Kenuz area. They differ from the three original Nubian ethnic groups in origin, culture, and language.

My present analysis comprises fifty-two features: nine measurements and eleven indices of cephalometry, nine measurements and eleven indices of somatometry, eight measurements and one index of body composition features, and three physiological measurements. The anthropometric technique was that of Martin and Saller (1957), and numbers of measurements given in parenthesis in Tables 1 through 5 refer to this standard work.[1] All indices labelled as "relative" are those in which the measurement was calculated as a percentage of the stature. Skinfold thickness was measured with a Best (1954) caliper with a standard pressure of 7 grams per square millimeter. The pulse rate

[1] Cubit length (Martin and Saller 1957: Number 48 [3]) was measured from the olecranon to the top of the middle finger. All pair measurements were done on the left side.

and the blood pressure were determined after a ten-minute rest of the proband.

Means (not published here) and standard deviations were computed for the whole Nubian series, composed of the Kenuz, Arab, Fadidja, and Ababda samples. The differences found between the means of individual variables of sample pairs were divided by the corresponding standard deviations of the whole Nubian series:

$$d_V = \frac{\bar{x}_a - \bar{x}_b}{S_V},$$

where d is a standardized difference between means $\bar{x}$ of samples a and b for each variable V, and S is the standard deviation of the whole Nubian series for variable V.

This enables us to compare directly differences among variables regardless of the absolute size of the variables (e.g. stature and nasal breadth) with respect to their variability, as well as to calculate mean differences of sets of measurements or indices, whether craniometric, somatometric, body composition, or physiological:

$$\bar{d}_{1\ldots n} = \frac{d_1 + \ldots d_n}{n},$$

where $\bar{d}_{1\ldots n}$ is the mean difference of a set of variables *1* to n, $d_1 \ldots d_n$ are the standardized differences of every variable, taken regardless of their signs (always added), and n is the number of variables.

No other "distance" statistics were applied for the moment. At the same time, all differences were tested for significance by means of the t- and F-tests.

RESULTS

Morphological Features

The mean values and standard deviations of cephalometric measurements, shown in Table 1, cephalometric indices, shown in Table 2, somatometric measurements, shown in Table 3, and somatometric indices, shown in Table 4, of the four ethnic groups inhabiting Egyptian Nubia are presented, together with the standardized differences (d_V) between pairs of all four samples and the results of the t- and F-tests. According to these tables, it is evident that Egyptian Nubian ethnic groups are well differentiated and that nothing like a definite "Egyptian Nubian population type" does exist. The following principal results of the analysis can be outlined:

1. The differences between the original sedentary Nubian ethnic groups, the Kenuz and the Fadidja, are generally very low. They are mostly expressed in cephalometric features ($\bar{d} = 0.223$), followed by cephalometric indices ($\bar{d} = 0.211$), somatometric indices ($\bar{d} = 0.196$), and somatometric measurements ($\bar{d} = 0.148$). Only three cephalometric measurements of the nine studied proved to be significantly greater for the Kenuz: head breadth, facial height, and nasal breadth. Further, three of the eleven cephalometric indices were significantly different (greater cephalic index for the Kenuz, greater breadth–height and transverse cephalo-facial indices for the Fadidja). Only a single somatometric measurement (biacromial breadth) of the nine studied was found significantly larger in Kenuz than in Fadidja. Of eleven somatometric indices, significant differences appeared in only three of them (greater relative arm length and cubit length in the Fadidja, greater acromio-iliac index in the Kenuz). As a whole, only 25 percent of all forty features were significantly different, and the total average difference (d) amounted to only 0.196.

2. The Nubian Arab, who settled between the areas of the two original Nubian ethnic groups in the Middle Ages, mainly in the fourteenth century, were found to be more distinct from the Fadidja and especially so from the Kenuz.

When compared with the Fadidja, the Arab difference is greatest in the somatometric measurements ($\bar{d} = 0.282$), less in cephalometric measurements ($\bar{d} = 0.221$), still less in cephalometric indices ($\bar{d} = 0.148$), and least in somatometric indices ($\bar{d} = 0.098$). Thus the difference appears more in the size (expressed by measurements) than in the shape (expressed by indices). All cephalometric measurements of the Arab were found to be smaller than those of the Fadidja, five of the nine studied significantly so: length, breadth, and height of the head; minimum frontal breadth; and nasal breadth. Of the eleven cephalometric indices, only three showed significantly smaller values for the Arab than for the Fadidja: length–height and breadth–height indices of the head, and jugo-nasal index. Also, all Arab somatometric measurements were smaller;

Key to Tables 1–5

n = number of examined persons (the "All Nubians" category is larger than the sum of the four Nubian ethnic groups because of the inclusion of intra-Nubian hybrids).
$\bar{x}$ = arithmetic mean.
s = standard deviation of sample,
S = general standard deviation of all Nubians.
d_V = standardized difference between sample pairs.

[a] Only three persons examined.
[b] F-test significant ($P = 0.05$).
[c] t-test significant ($P = 0.05$).
[d] t-test significant ($P = 0.01$).
[e] t-test significant ($P = 0.001$).

Table 1. Cephalometric measurements of the Nubian ethnic group samples (adult men) and their differences

Measurements (numbers after Martin and Saller 1957)	1. Kenuz (n = 103)		2. Fadidja (n = 175)		3. Arab (n = 115)		4. Ababda (n = 24)		All Nubians (n = 425)	Differences, t- and F- tests					
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	S	1–2 d_V	2–3 d_V	1–3 d_V	3–4 d_V	2–4 d_V	1–4 d_V
Head length (mm) (1)	190.6	7.5	190.5	6.4	188.9	6.1	189.7	7.7	6.6	0.015	0.242[c]	0.257[b]	−0.121	0.121	0.136
Head breadth (mm) (3)	147.8	5.7	145.2	4.8	144.0	4.6	145.2	6.4	5.2	0.500[e]	0.230[c]	0.730[b,e]	−0.230[b]	0[b]	0.500
Auricular height (mm) (15)	125.8	5.3	126.6	5.4	124.0	4.1	122.7[a]	5.3	5.1	−0.156	0.509[b,e]	0.352[b,d]	0.254[b,c]	0.764[b,e]	0.607[b,e]
Minimum frontal breadth (mm) (4)	105.0	4.8	103.9	4.6	102.7	4.8	104.8	4.8	4.7	0.234	0.255[c]	0.489[e]	−0.446	−0.191	0.042
Facial height (mm) (18)	122.0	7.0	119.4	7.1	118.3	7.0	118.0	6.6	7.1	0.366[d]	0.154	0.521[e]	0.042	0.197	0.563[c]
Bizygomatic breadth (mm) (6)	135.1	5.8	134.1	5.5	133.6	4.6	132.8	4.9	5.3	0.188	0.094[b]	0.283[b,c]	0.150	0.245	0.433
Bigonial breadth (mm) (8)	102.0	6.0	101.2	5.7	101.2	5.4	101.6	4.4	5.6	0.142	0	0.142	−0.071	−0.071	0.071
Nasal height (mm) (21)	55.2	4.5	54.7	4.1	53.9	3.1	52.6	4.6	4.0	0.125	0.200[b]	0.325[b,c]	0.325[b]	0.525[c]	0.650[c]
Nasal breadth (mm) (13)	40.4	3.7	39.4	3.5	38.3	3.4	37.5	3.7	3.6	0.277[c]	0.305[d]	0.583[e]	0.222	0.527[c]	0.805[e]

Table 2. Cephalometric indices of the Nubian ethnic group samples (adult men) and their differences

Measurements (numbers after Martin and Saller 1957)	1. Kenuz (n = 103)		2. Fadidja (n = 175)		3. Arab (n = 115)		4. Ababda (n = 24)		All Nubians (n = 425)	Differences, t- and F- tests					
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	S	1–2 d_V	2–3 d_V	1–3 d_V	3–4 d_V	2–4 d_V	1–4 d_V
Cephalic index (3:1)	77.6	3.6	76.3	3.1	76.3	3.0	76.7	5.0	3.4	0.382[d]	0	0.382[d]	−0.117[b]	−0.117[b]	0.264[b]
Length–height index (15:1)	66.1	3.0	66.5	3.0	65.7	2.5	66.0[a]	2.2	2.9	−0.137	0.275[b,c]	0.137[b]	−0.103	0.172	0.034
Breadth–height index (15:3)	85.2	4.0	87.2	3.6	86.1	3.5	84.4[a]	3.3	3.7	−0.540[e]	0.297[d]	−0.243	0.459	0.756	0.216
Transverse fronto-parietal index (4:3)	71.1	3.2	71.6	3.1	71.3	2.9	71.9	4.6	3.2	−0.156	0.093	−0.062	−0.187[b]	−0.093[b]	−0.250[b]
Facial index (18:6)	90.3	5.7	89.2	5.6	88.6	5.1	89.0	4.8	5.5	0.200	0.109	0.309[c]	−0.072	0.036	0.236
Jugofrontal index (4:6)	77.8	3.5	77.6	3.3	76.9	3.1	79.0	2.7	3.3	0.060	0.212	0.272[c]	−0.636[d]	−0.424	−0.363
Jugomandibular index (8:6)	75.6	4.0	75.5	3.7	75.8	3.6	76.7	3.9	3.8	0.026	−0.078	−0.052	−0.236	−0.315	−0.289
Transverse cephalo-facial index (6:3)	91.4	3.3	92.4	3.2	92.8	2.9	91.5	4.0	3.2	−0.312[c]	−0.125	−0.437[e]	0.406[b]	0.281	−0.031
Nasal index (13:21)	73.6	9.1	72.3	8.2	71.2	6.9	71.5	7.6	8.1	0.160	0.135[b]	0.296[b,c]	−0.037	0.098	0.259
Jugonasal index (13:6)	29.9	2.6	29.4	2.6	28.7	2.5	28.2	2.5	2.6	0.192	0.269[c]	0.461[e]	0.192	0.461[c]	0.653[d]
Facionasal index (21:18)	45.3	3.6	45.8	3.1	45.7	3.2	44.6	2.9	3.2	−0.156	0.031	−0.125	0.343	0.375	0.218

Table 3. Somatometric measurements of the Nubian ethnic group samples (adult men) and their differences

Measurements (numbers after Martin and Saller 1957)	1. Kenuz (n = 103)		2. Fadidja (n = 175)		3. Arab (n = 115)		4. Ababda (n = 24)		All Nubians (n = 425)	Differences, t- and F- tests					
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	S	1–2 d_V	2–3 d_V	1–3 d_V	3–4 d_V	2–4 d_V	1–4 d_V
Weight (kg) (71)	62.7	12.8	61.9	10.1	58.8	9.9	57.2	9.4	10.6	0.075[b]	0.292[c]	0.367[b,c]	0.150	0.443[c]	0.518
Stature (cm) (1)	169.8	6.8	168.5	5.8	166.2	6.3	167.2	7.4	6.4	0.203	0.359[d]	0.562[e]	−0.156	0.203	0.406
Sitting height (cm) (23)	86.6	3.8	86.4	3.2	84.9	3.2	85.2	3.9	3.5	0.057	0.428[e]	0.485[e]	−0.085	0.342	0.400
Upper extremity length (cm) (45)	77.2	3.5	77.3	3.4	76.1	3.7	76.3	4.3	3.6	−0.027	0.333[d]	0.305[c]	−0.055	0.277	0.250
Cubit length (cm) (48.3)	47.0	2.2	47.3	2.2	46.4	3.1	46.8	3.0	2.3	−0.130	0.391[b,d]	0.260[b]	−0.173	0.217[b]	0.086
Biacromial breadth (cm) (35)	37.7	2.0	38.5	1.9	37.7	1.9	37.7	2.4	1.9	−0.421[e]	0.421[e]	0	0	0.421	0
Bicristal breadth (cm) (40)	27.2	2.0	26.8	1.7	26.7	2.2	26.5	1.9	1.9	0.210	0.052[b]	0.263	0.105	0.157	0.368
Breadth of thorax (cm) (36)	26.6	2.1	26.3	1.8	26.0	1.8	25.3	1.9	1.9	0.157	0.157	0.315[c]	0.368	0.526[c]	0.684[d]
Depth of thorax (cm) (37)	19.7	2.1	19.6	1.8	19.4	1.6	18.7	1.4	1.8	0.055	0.111[b]	0.166[b]	0.388[c]	0.500[c]	0.555[b,d]

Table 4. Somatometric indices of the Nubian ethnic group samples (adult men) and their differences

Measurements (numbers after Martin and Saller 1957)	1. Kenuz (n = 103)		2. Fadidja (n = 175)		3. Arab (n = 115)		4. Ababda (n = 24)		All Nubians (n = 425)	Differences, t- and F-tests					
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	S	1–2 d_V	2–3 d_V	1–3 d_V	3–4 d_V	2–4 d_V	1–4 d_V
Rohrer's index (71:1)	1.28	0.22	1.29	0.20	1.28	0.21	1.22	0.17	0.21	−0.047	0.047	0	0.285	0.333	0.285[d]
Cormic index (23:1)	51.0	1.3	51.3	1.4	51.1	1.5	50.9	1.3	1.4	−0.214	0.142	−0.071	0.142	0.285	0.071
Relative upper extremity length (45:1)	45.4	1.4	45.9	1.3	45.8	1.2	45.6	1.2	1.3	−0.384[d]	0.076	−0.307[c]	0.153	0.230	−0.153
Relative cubit length (48.3:1)	27.7	0.9	28.1	0.9	28.0	0.8	28.0	0.9	0.9	−0.444[e]	0.111[b]	−0.333[d]	0	0.111	−0.333
Relative biacromial breadth (35:1)	22.6	1.2	22.8	1.1	22.7	1.0	22.6	1.2	1.1	0.181	0.090	−0.090	0.090	0.181	0
Relative bicristal breadth (40:1)	16.0	1.0	15.9	1.0	16.1	1.2	15.9	1.0	1.2	0.083	−0.166	−0.083	0.166	0	0.083
Relative breadth of thorax (36:1)	15.6	1.2	15.6	1.1	15.6	1.1	15.1	1.0	1.0	0	0	0	0.500	0.500[c]	0.500
Relative depth of thorax (37:1)	11.6	1.2	11.6	1.1	11.7	1.0	11.2	0.9	1.1	0	−0.090	−0.090	0.454[c]	0.363	0.363
Cubit length in percent of upper extremity length (48.3:45)	60.9	1.4	61.2	1.0	61.1	1.2	61.5	1.2	1.2	−0.250	0.083[b]	−0.166	−0.333	−0.250	−0.500
Acromio-iliac index (40:35)	72.4	5.4	69.9	4.3	71.0	5.0	70.3	3.7	4.9	0.510[b,e]	−0.224[c]	0.285[c]	0.142	−0.081	0.428[b,c]
Thoracic index (37:36)	74.4	6.9	74.8	8.2	75.2	6.3	74.8	8.8	8.0	−0.050[b]	−0.050[b]	−0.100	0.050[b]	0	−0.050

six of the nine studied differed significantly: weight, stature, sitting height, arm length, cubit length, and biacromial breadth. In somatometric indices, however, only one of the eleven calculated, the acromio-iliac index, was found to be significantly higher for the Arab than for the Fadidja. As a whole, 35 percent of all the features were significantly different; the total average difference ($\bar{d}$), however, amounted to only 0.181, which is still slightly less than the corresponding difference between the original Nubian ethnic groups, stated above.

More distinction was found between the Arab and the Kenuz. They differed mainly in cephalometric measurements ($\bar{d} = 0.409$); less, but still remarkably, in somatometric measurements ($\bar{d} = 0.303$); less in cephalometric indices ($\bar{d} = 0.252$); and least in somatometric indices ($\bar{d} = 0.139$). Again, the difference in size is far greater than the difference in shape. All nine cephalometric measurements were smaller for the Arab than for the Kenuz, seven of them significantly (head breadth and height, minimum frontal breadth, facial height, bizygomatic breadth, and nasal height and breadth). Of the eleven cephalometric indices, five were found significantly higher in the Kenuz (cephalic, facial, jugofrontal, nasal, and jugonasal indices), one was found significantly higher in the Arab (transverse cephalo-facial index). At the same time, all nine somatometric measurements were found to be smaller in the Arab than in the Kenuz, five of them significantly (weight, stature, sitting height, arm length, and thoracic breadth). Of eleven somatometric indices, however, only two showed significantly higher values in the Arab (relative arm length and relative cubit length), and one showed significantly higher values in the Kenuz (acromio-iliac index). As a whole, the percentage of significantly different features reached 55 percent and the total average difference ($\bar{d}$) was 0.268.

3. The sample of the recently settled Ababda is unfortunately too small to allow direct comparison with the three sedentary Nubian ethnic groups. The significance of some of their differences could not be proved because of their high standard deviations and the small sample size. The Ababda had, nevertheless, more significant differences when compared with the Kenuz (45 percent) and the Fadidja (40 percent) than when compared with the Arab (15 percent). However, a comparison of their actual standarized differences ($\bar{d}_v$) is far more expressive than the differences between the three sedentary Nubian ethnic groups among themselves.

These differences proved to be lowest when the Ababda were compared with the Arab. They were expressed mostly in cephalometric indices ($\bar{d} = 0.253$), less in cephalometric features ($\bar{d} = 0.207$) and somatometric indices ($\bar{d} = 0.210$), and least in somatometric measurements ($\bar{d} = 0.164$). Some absolute measurements were greater in the Arab (mostly nasal height and thoracic dimensions) and some in the

Ababda (minimum frontal breadth and head breadth). In this comparison the shape differences exceed the size differences. As a whole, the average difference of all features ($\bar{d}$) amounts to only 0.211, which is indeed greater than the Kenuzi–Fadidja and the Arab–Fadidja distinction but somewhat smaller than the Arab–Kenuz distinction.

More expressive differences were found between the Ababda and the Fadidja. They differ mainly in somatometric measurements ($\bar{d} = 0.343$), the Ababda being smaller in all measurements, and in cephalometric measurements ($\bar{d} = 0.294$), the Ababda again smaller in all measurements except the frontal and bigonial breadths, in which they were larger. Differences in cephalometric indices ($\bar{d} = 0.284$) and somatometric indices ($\bar{d} = 0.212$) are also clear-cut. In this comparison the shape differences are combined with their mutual size differences. As a whole, the average difference of all features ($\bar{d}$) is given as 0.279, which is still higher than the distinction between the Arab and the Kenuz.

The most different ethnic groups were found to be Ababda and Kenuz, notwithstanding the fact that they partly inhabited the same area. The greatest difference was found in smaller cephalometric ($\bar{d} = 0.423$) and somatometric ($\bar{d} = 0.363$) measurements of the Ababda, who can be labeled "desert dwarfs," compared with the Kenuz "riverain giants." But the shape features, expressed in both the cephalometric ($\bar{d} = 0.256$) and the somatometric ($\bar{d} = 0.251$) indices, are also readily distinguished. The total average difference ($\bar{d}$) between these two ethnic groups is 0.316, the greatest found among Nubian ethnic groups.

Body Composition Features

The mean values and standard deviations of measurements, according to which we may approximate body composition, the standardized differences (d_V) between pairs of all four samples, and the results of the t- and F-tests are given in Table 5.

The bony component, assessed according to the wrist breadth, was found to be largest (significantly) in the Kenuz, followed by the Fadidja and the Ababda, and least in the Arab. When this measurement was expressed in relation to stature, however, all Nubian ethnic groups showed the same value except the Arab, whose skeleton seems to be significantly less robust.

The muscular component can be assessed by the maximum circumferences of both the arm and the calf, as well as by functional measures, the maximum grip strength of the right and left hands (dynamometry). The values of the Kenuz and Fadidja were found to be very close, differing only by $\bar{d} = 0.103$. The Arab compared with the Fadidja showed significantly greater pressure force of the right hand, and they differed mutually

Table 5. Body composition and physiological features of the Nubian ethnic group samples (adult men) and their differences

Features (numbers after Martin and Saller 1957)	1. Kenuz (n = 103) $\bar{x}$	s	2. Fadidja (n = 175) $\bar{x}$	s	3. Arab (n = 115) $\bar{x}$	s	4. Ababda (n = 24) $\bar{x}$	s	All Nubians (n = 425) S	Differences, t- and F- tests 1–2 d_V	2–3 d_V	1–3 d_V	3–4 d_V	2–4 d_V	1–4 d_V
Wrist breadth (cm) (52.4)	5.6	0.36	5.5	0.34	5.4	0.29	5.5	0.35	0.34	0.294[c]	0.294[b,d]	0.588[e]	−0.294	0	0.294
Relative wrist breadth (cm) (52.4:1)	3.3	0.22	3.3	0.18	3.2	0.16	3.3	0.17	0.19	0[b]	0.526[e]	0.526[b,e]	−0.526[d]	0	0
Maximum circumference of arm (cm) (65)	27.1	3.6	26.7	2.9	26.1	3.0	25.0	2.4	3.1	0.129[b]	0.193	0.322[c]	0.354	0.548[d]	0.677[b,e]
Maximum circumference of calf (cm) (69)	33.3	3.3	32.6	2.7	32.0	3.0	31.1	3.4	3.0	0.233[b]	0.200	0.433[d]	0.300	0.500[c]	0.733[d]
Grip strength of right hand (kg)	34.6	8.3	34.6	8.1	36.6	7.2	34.4	8.0	7.9	0	−0.253[c]	−0.253	0.278	0.025	0.025
Grip strength of left hand (kg)	31.2	7.2	31.6	8.0	32.3	7.5	30.0	7.6	7.7	−0.051	−0.090	−0.142	0.298	0.207	0.155
Skinfold thickness, tricipital (cm)	0.60	0.44	0.66	0.43	0.69	0.46	0.77	0.50	0.45	−0.133	−0.066	−0.200	−0.177	−0.244	−0.377
Skinfold thickness, subscapular (cm)	0.94	0.71	1.09	0.74	1.12	0.61	1.01	0.68	0.70	−0.214	−0.042[b]	−0.257[c]	0.157	0.114	−0.100
Skinfold thickness, cristal (cm)	0.71	0.60	0.73	0.55	0.82	0.57	0.90	0.72	0.59	−0.033	−0.152	−0.186	−0.135	−0.288[b]	−0.322
Pulse rate (per minute)	76.5	9.0	73.0	8.2	74.2	7.7	79.8	12.6	8.9	0.393[d]	−0.134	0.258[c]	−0.629[b]	−0.764[b,c]	−0.370[b]
Systolic blood pressure (mm Hg)	124.6	15.8	118.2	14.1	118.5	10.6	126.5	10.4	13.9	0.460[e]	−0.021[b]	0.438[b,d]	−0.575[d]	−0.597[d]	−0.136[b]
Diastolic blood pressure (mm Hg)	80.4	9.9	77.7	9.5	79.0	8.8	80.9	10.4	9.5	0.284[c]	−0.136	0.147	−0.200	−0.336	−0.052

by $\bar{d} = 0.184$. The Arab, however, showed significantly smaller circumferences of both arm and calf in comparison with the Kenuz, and their mutual differences amounted to $\bar{d} = 0.288$. Most distinct was the muscular component in the Ababda, whose values were lower when compared with other ethnic groups (significantly, the circumferences compared with those of the Kenuz and the Fadidja). Their differences with the Arab where $\bar{d} = 0.308$, with the Fadidja $\bar{d} = 0.320$, and with the Kenuz $\bar{d} = 0.398$. Thus the results of comparison of the muscular component are of the same order as the comparison of morphological features, the differences with Ababda being still higher than in morphology.

The fat component was assessed by means of the skinfold thickness in three areas: the middle of the posterior surface of the arm above m. triceps brachii (tricipital), under the lower angle of the scapula (subscapular), and above the iliac crest in the anterior axillary line (cristal). Between the Kenuz and the Fadidja only a low difference ($\bar{d} = 0.127$) was found, all skinfolds being a little thicker with the Fadidja. The Arabs show values very similar to the Fadidja, differing only in $\bar{d} = 0.087$; the Arab skinfolds were found to be a bit thicker than those of the Fadidja. The Arabs, therefore, have far thicker skinfolds than the Kenuz, with the difference $\bar{d} = 0.214$. The difference in the subscapular skinfold proved to be significant. The Ababda were found to be closest to the Arab, having thicker tricipital and cristal skinfolds but thinner subscapular skinfolds, and differing by $\bar{d} = 0.156$. All Ababda skinfolds were distinctly thicker than those of the Fadidja ($\bar{d} = 0.215$), and still more than those of the Kenuz ($\bar{d} = 0.266$). Thus the order of the Nubian ethnic groups according to the fat component seems to be quite reversed from their arrangement by morphological features. The morphologically biggest Kenuz were found to be the leanest, and the morphologically smallest Ababda proved to be relatively the fattest.

Physiological Features

Only three physiological features revealing the function of the circulatory system could be studied: pulse rate and systolic and diastolic pressure. The results are included in Table 5. The Fadidja and the Arab were very similar in these features, differing only nonsignificantly by $\bar{d} = 0.097$. The Kenuz compared with the Arab showed higher values, significant in pulse rate and systolic blood pressure; their difference amounted to $\bar{d} = 0.281$. The Kenuz and the Fadidja, morphologically closest, differed greatly ($\bar{d} = 0.379$), all the values of the Kenuz being significantly higher. The Ababda, however, yielded higher values for all three features than did the other sedentary Nubian groups. Their difference compared with the Kenuz was slight and nonsignificant ($\bar{d} = 0.186$). Compared with the

Arab it was far greater ($\bar{d} = 0.468$) and significant for systolic blood pressure. Compared with the Fadidja the difference proved to be extremely high ($\bar{d} = 0.566$), significant for pulse rate as well as for systolic blood pressure.

Thus, physiologically "good" results were found for the Fadidja, followed rather closely by the Arab. "Bad" values were found for the Kenuz and especially for the Ababda. These results seem to be rather independent of morphological as well as of body composition features.

DISCUSSION

The morphological likeness of the Kenuz and the Fadidja, in spite of the fact that their areas have been separated since the Middle Ages by a strip of Nubian Arab territory, can easily be explained by their common roots. Since the withdrawal of Roman garrisons from the northernmost part of Egyptian Nubia in A.D. 297 the Nubian X-group people extended along the course of the Nile (Strouhal 1971c). In the Christian period (sixth to fourteenth centuries), the population remained united in the Nobadia kingdom. Nevertheless, different foreign groups began to penetrate both northern and southern Egyptian Nubia. But the slight differences found between the recent Kenuz and Fadidja were most obviously caused by different foreign influxes during the Ottoman Turkish period (sixteenth to eighteenth centuries). People of Middle Eastern, Circassian, and even Balkan origin were brought by the Turkish army into the southern part of Nubia, inhabited by the Fadidja. At the same time, the influx of black slaves from the Sudan was greater in the wealthier south than in the poorer north.

The Arab islet in Nubia conserved not only its Arabic language and different culture (Herzog 1957) but, as shown by our results, a definite morphological distinction when compared with the two original Nubian ethnic groups. This distinction, which manifests itself more in size than in shape, results from a rate of inbreeding that is very high for all the Nubian ethnic groups, especially the Arab (Hussien 1971a, 1971b; Strouhal 1971b). From the stability of social rules and habits we may assume that endogamy prevailed there for many generations. Exogamic marriages with members of other Nubian ethnic groups were found very rarely. The greater proximity of the Arab to the Fadidja than to the Kenuz is difficult to explain. Some similarity in their stock components, similar selective factors, relatively greater intermingling, or simply chance could have been involved.

The Ababda, being of quite different origin among the Beja tribes of the Eastern desert, were very little influenced by different population groups of the Nile Valley proper. Hence their clear-cut distinction in size

as well as shape when compared with both the Kenuz and the Fadidja. Their relatively greater similarity to the Arab can be explained by similarities of their aboriginal stocks, by geographic proximity, and by the climatic and environmental similarity of their homelands (Eastern desert and Arabian peninsula), as well as by adaptation to the (originally) same way of life (desert nomadism). Their low stature, small body and head dimensions, and smaller muscular development could easily be results of such an adaptation.

Of the body composition features, only the fat component showed a reversed sequence from the results of the morphological distinction among the studied groups. The low fat component in the Kenuz and Fadidja and the rather high rate in the Arab and especially in the Ababda could reflect basically different food habits. Old Nubia was a very barren country and lacked an adequate supply of food, which was imported mainly from Egypt. The Ababda, on the other hand, could profit from milk and milk products gained from their camel herds. It remains an open question why the Arab showed a relatively better state of nutrition.

The results of physiological (circulatory) features, "better" with the Fadidja and the Arab and "worse" with the Kenuz and Ababda, could reflect some geographic trends, connected by minor climatic differences. These features may be due not to pathological influences but rather to different physiological adaptation to environmental demands.

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Heterosis and Homosis in Man

NAPOLEON WOLAŃSKI

Heterosis and its antithesis homosis are not universally understood or agreed-upon concepts in genetics, particularly as far as man is concerned. To avoid ambiguity, therefore, we set out graphically in Figure 1 the sense in which these terms will be used here and summarize our knowledge of the consequences of heterosis and homosis in man.

The notions of heterosis and homosis embrace all of the genetic consequences of heterogeneity and homogeneity, respectively. It is obvious that in the study of these phenomena it is not possible to deal with all the intermediate forms, in view of the difficulty in assaying the degree of homo- or heterogeneity in human populations. Neither can one speak in man of "pure lines" such as we find in plant and animal breeding. The order of processes leading to heterosis or homosis can nevertheless be presented in approximation as in Figure 2. This order will not always agree with the coefficients of inbreeding or kinship, since (as for instance in the case of dynastic marriages between ruling houses) outcrossing may actually occur within the framework of related families. The sequences shown are, however, helpful in the analysis of the phenomena discussed, particularly when in their investigation we wish to concentrate on extreme cases.

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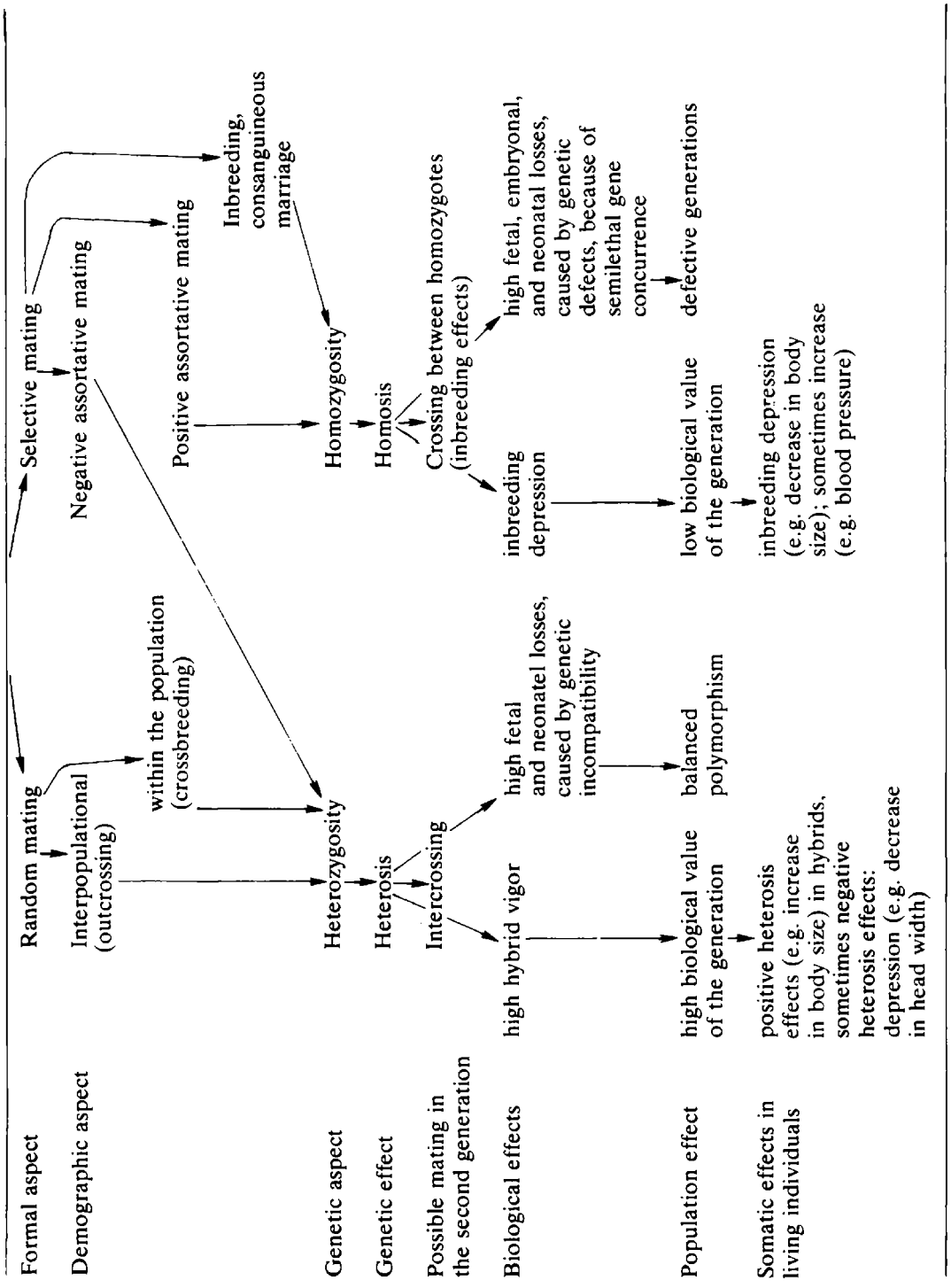
Formal aspect
Demographic aspect
Genetic aspect
Genetic effect
Possible mating in the second generation
Biological effects
Population effect
Somatic effects in living individuals
Random mating
Interpopulational (outcrossing)
within the population (crossbreeding)
Selective mating
Negative assortative mating
Positive assortative mating
Inbreeding, consanguineous marriage
Heterozygosity
Homozygosity
Heterosis
Homosis
Intercrossing
Crossing between homozygotes (inbreeding effects)
high hybrid vigor
high fetal and neonatel losses, caused by genetic incompatibility
inbreeding depression
high fetal, embryonal, and neonatal losses, caused by genetic defects, because of semilethal gene concurrence
high biological value of the generation
balanced polymorphism
low biological value of the generation
defective generations
positive heterosis effects (e.g. increase in body size) in hybrids, sometimes negative heterosis effects: depression (e.g. decrease in head width)
inbreeding depression (e.g. decrease in body size); sometimes increase (e.g. blood pressure)

Figure 1. Mating patterns and their biological effects on a population, resulting from breeding (Wolański 1972)

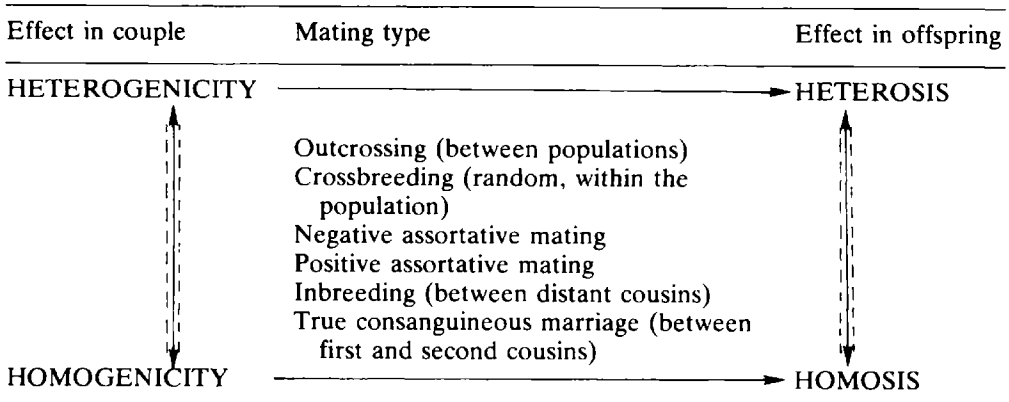

Figure 2. Mating patterns favourable for heterosis and homosis in offspring, from potentially most heterogenous to most homogenous couples

PRESUMABLE POPULATION MECHANISMS

Obviously, negative assortative mating favors heterosis and positive assortative mating homosis. In contemporary human populations, in general, cases of positive assortative mating may be found, as shown in Tables 1 through 3 (see also Spuhler's list: 1968). Thus there exists a tendency to homosis in the progeny. It is interesting that traits which are probably unrecognizable without special laboratory tests, like enzyme activity in the blood, demonstrate positive assortative mating (Table 2). This is also true for such psychomotor traits as muscular strength, simple reaction time, and motor coordination (Table 3). The question may, therefore, arise whether, in the case of readily varying traits under the influence of life conditions (e.g. enzyme level), the existing similarity between spouses is evidence of assortative mating in this respect or, alternatively, whether it is the result of mating of these two subjects and of leading a life in common (influence of the same nutrition, motor activity, etc.), these conditions showing a greater resemblance for both spouses in rural than in urban circumstances.

The only known common examples of negative assortative mating concern the number of illnesses and pulse rate after exercise (Smith 1946). A trace of a similar phenomenon is found in our material (Table 3); it concerns endurance fitness (maximal oxygen uptake) and accuracy of movement within a narrow reach (60°). The correlation coefficients, however, are not statistically significant, although they are negative in both the generations tested.

In Spuhler's investigation (1968) of the small isolated Ramah Navaho Indian population of western New Mexico, most of the traits examined indicate negative assortative mating. It should be added that the tribe in question consisted in 1870 of thirty-five families with progeny, and that in

Table 1. Assortative mating with respect to hair and eye color, blood groups, haptoglobin type, functional asymmetry, and proprioceptive feeling in population from Polish rural area

Trait	Grandparent generation			Parent generation		
	χ^2	d.f.	n	χ^2	d.f.	n
Hair color	18.4	25	74	47.2[b]	25	389
Eye color	37.7	49	64	48.6[a]	49	378
ABO blood groups	6.4	9	24	12.1	9	153
Rh blood groups	4.2	1	19	0.0	1	148
M blood groups	0.0	1	12	0.4	1	113
N blood groups	0.9	1	11	0.0	1	112
Duffy blood groups	0.0	1	5	0.1	1	39
Kidd blood groups	0.0	1	3	4.0[a]	1	22
Hp phenotypes	0.0	4	3	6.7	4	35
Hand clasping	10.0[a]	4	9	1.5	4	73
Arm folding	3.5	4	9	7.6	4	73
Leg folding	1.4	4	9	2.8	4	73
Proprioceptive feeling (direction of errors)	0.0	4	4	4.4	4	65

[a] Significant at 0.05 level.
[b] Significant at 0.01 level.

1948 there were 115 such families, the entire group consisting of 614 individuals. It is perhaps the result of negative assortative mating that the inbreeding coefficient for this population living in relative isolation is 0.0066 (Kluckhohn 1966), whereas for instance in the Hutterite population (South Dakota, Minnesota, and Manitoba) this coefficient amounts to 0.0216, the number of families being 667 (Mange 1964).

Where there is high inbreeding in the population, congenital malformations are frequent. To give an example, the coefficient of correlation (r) between neonatal mortality rates caused by congenital malformation and immigration rates in various counties in Poland ranges for various years from -0.1207 to -0.4225 and is statistically significant (Wolański 1970a).

On the other hand, it is also known that in populations with wide genetic differences (e.g. the city of Szczecin in which the mean mating radius amounts to 270 km, and in which 97 percent of the population changed in the years 1946–1947 due to a change of national status) fetal and newborn losses are the highest found in Poland, as shown in Figure 3 (Wolański et al. 1970, Wolański 1970b). Fetal losses are also high in families in which the ancestors of the spouses originate from several different countries (Bresler 1970).

In this respect a comparison, shown in Table 4, based on the fertility index (mean number of pregnancies) and survival index (number of children surviving as percent of all pregnancies of the mother) in families with different mating radius and various combinations of blood groups of

Table 2. Assortative mating with respect to morphological, physiological, and biochemical properties in Polish rural populations

Traits	Grandparent generation		Parent generation	
	r	*n*	*r*	*n*
Stature (B-v)	0.07	59	0.20[b]	377
Skinfold thickness	0.41	12	0.05	95
Trunk length (sst-sy)	0.16	59	0.14[b]	371
Upper extremity length (a-da)	−0.03	59	0.19[b]	373
Shoulder breadth index	0.35[b]	59	0.02	375
Hip breadth index	0.00	58	0.24[b]	375
Hand length (sty-da)	0.16	12	0.08	113
Hand breadth (mr-mu)	0.04	12	0.12	113
Foot length (pte-ap)	−0.18	11	0.03	113
Foot breadth (mtt-mtf)	0.40	11	−0.08	113
Head length (g-op)	−0.22	63	0.30[b]	380
Cephalic index	−0.16	63	0.07	381
Total facial height (n-gn)	0.13	63	0.03	379
Nasal height (n-sn)	0.37[b]	63	0.12[a]	380
Minimal frontal breadth (ft-ft)	0.14	63	0.13[b]	380
Mandibular breadth (go-go)	0.44[b]	63	−0.02	380
Total facial index	0.15	63	0.02	380
Upper facial index	0.16	61	0.25[b]	380
Interocular breadth (en-en)	0.21	62	0.16[b]	379
Total ear height (sa-sba)	0.33[b]	63	0.05	380
Upper ear height (sa-in)	0.20	63	0.26[b]	380
Ear breadth (pa-pra)	0.32[a]	63	0.23[b]	380
Ear height index	0.25[a]	63	0.21[b]	381
Ear breadth index	0.32[a]	62	0.24[b]	381
Haptoglobin level	0.99[b]	3	0.76[b]	33
Lactate dehydrogenase (LDH)	0.67	6	0.36[b]	70
Malate dehydrogenase (MDH)	0.66	6	0.44[b]	68
Alkaline phosphatase (AP)	0.28	9	0.80[b]	81
Fructo-di-phospho-aldolase (FDPA)	0.53	9	0.32[b]	92
Aspartic aminotransferase (AspAT)	0.07	10	0.28[b]	91
Alanine aminotransferase (ALAT)	−0.01	8	0.08	61
Systolic blood pressure	0.18	46	0.14[a]	253
Diastolic blood pressure	0.23	45	0.22[b]	253

[a] Significant at 0.05 level.
[b] Significant at 0.01 level.

the Rh system, is interesting. A higher fertility (Table 4) is noted in endogamous and heterogenous couples as regards the Rh blood group (when the husband has Rh^+ and the wife Rh^-) as compared with exogamous couples. It is noteworthy that where fertility is higher, the survival index of the children is lower; that is, there are greater losses of fetuses and higher neonatal mortality. In view of this the net differences in the number of children reaching sexual maturity are relatively slight between endo- and exogenous (or homo- and heterogenous) families.

Table 3. Assortative mating with respect to psychomotor properties in Polish rural population

Traits	Grandparent generation		Parent generation	
	r	*n*	*r*	*n*
Grip strength of right hand	0.97[b]	6	0.74[b]	37
Grip strength of left hand	0.94[b]	6	0.77[b]	38
Muscular strength of shoulders	0.76[a]	6	0.53[b]	38
Back lift muscular strength	0.20	6	0.44[b]	36
Pulse increase after step test	0.43	4	0.09	83
Maximal oxygen uptake	−0.45	4	−0.01	83
Reaction time, optical stimulus	0.12	8	0.64[b]	56
Reaction time, acoustic stimulus	−0.03	8	0.52[b]	56
Reaction time, tactile stimulus	−0.04	7	0.57[b]	45
Turning balance per time			0.25	47
Walking balance			−0.06	49
Turning balance			0.04	45
Coordination, right hand	0.58	9	0.55[b]	72
Coordination, left hand	0.83[b]	9	0.53[b]	72
Coordination per time, right hand	0.14	9	0.35[b]	72
Coordination per time, left hand	0.41	9	0.24[a]	72
Movement accuracy, 120° right hand	0.48	4	0.16	63
Movement accuracy, 120° left hand	0.71	4	0.14	63
Movement accuracy, 60° right hand	−0.29	5	−0.08	66
Movement accuracy, 60° left hand	−0.20	5	−0.11	66

[a] Significant at 0.05 level.
[b] Significant at 0.01 level.

Table 4. Fertility (mean number of pregnancies) and survival index (surviving children as percent of all pregnancies) in families (*n* = number under study) with various mating radii and Rh blood types

	Mean number of pregnancies	Survival index	*n*
Mating radius:			
0 km, endogamous	7	73	43
exogamous, 1–11 km	6	75	57
exogamous, 11 km or more	5	83	36
Rh blood group:			
man Rh−, woman Rh+	6	80	20
man and woman both Rh+ (or both Rh−)	6	78	88
man Rh+, woman Rh− (potential serological conflict)	8	68	14

From the foregoing data the conclusion may be drawn that both too wide genetic differences and their lack between spouses may produce unfavourable effects in the progeny. This leads to the supposition that there is some mechanism whereby assortative selection plays a role in the maintenance of genetic balance in a population:

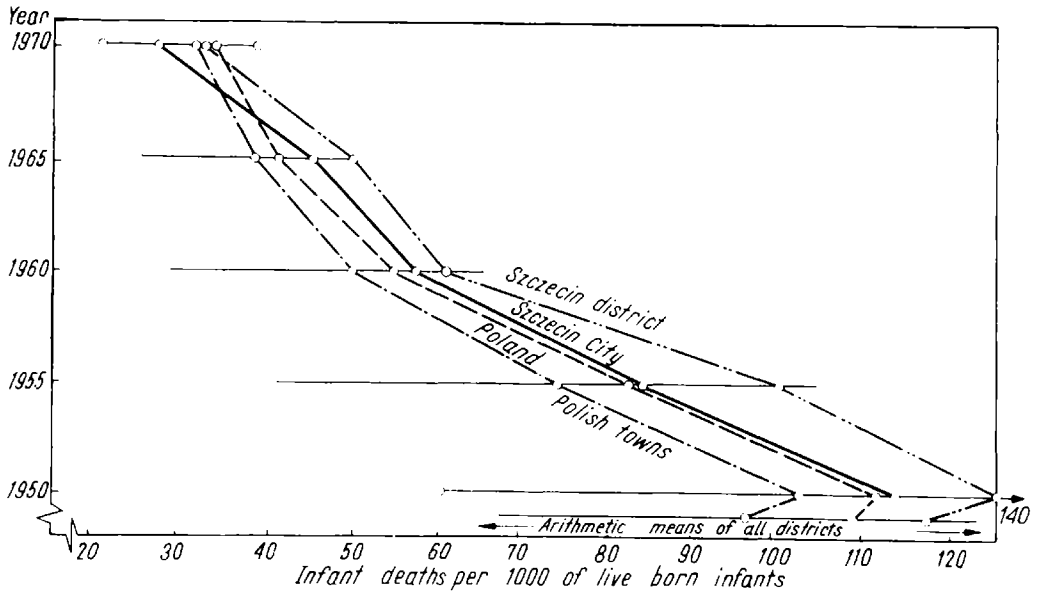

Figure 3. Death rate of newborn infants per 1,000 live born in Szczecin and the Szczecin district as compared with the average values for Polish cities and the scope of variations of means specific for the particular districts in the period 1949–1970 (Wolański 1970b)

1. Owing to increased migration, as is the case in the Polish rural districts investigated, positive assortative mating in the parental generation is more frequent than in the generation of the grandparents (Tables 1–3). Migration increases the chances of outcrossing, and this may lead to an increased heterogeneity of the population. Thus, as the intensity of positive assortative mating increases, a greater homogeneity of couples in the same population results.

2. Negative assortative mating appears in traits important for the existence of the family and the raising of the progeny. For example, at least one of the parents must be healthy, exhibiting high physical performance, in order to provide for the family. This is particularly important in the conditions of the Polish villages under study, where income is based on individual farming. Negative assortative mating here plays a conservative role.

3. Negative assortative mating has been noted, on the other hand, in the isolated Ramah Navaho tribe, where it seems to counteract the unfavorable consequences of homosis resulting naturally from inbreeding. Here too its effect upon the population is conservative.

SOME PRESUMABLE MECHANISMS REVEALING THE EFFECTS OF HETEROSIS AND HOMOSIS IN THE PROGENY

From the foregoing considerations we conclude that assortative mating, both positive and negative, is very important in the maintenance of the

genetic equilibrium of a population. The mechanism of this phenomenon is, however, not clear, and the effects of heterosis and homosis on the progeny of heterogenous and homogenous spouses require explanation.

It should be recalled that, as regards continuously distributed traits, the children usually exhibit values intermediate between the parental ones, hence more similar to the so-called midparent value than to the individual traits of the parents (Garn and Rohmann 1966).

Heterosis is quantitatively defined as overdominance, that is, the occurrence in the progeny of traits with values exceeding those found in the parents. This phenomenon is to be distinguished from dominance, the latter term denoting the appearance of the same value in the child as in one of the parents, who has dominant genes for the given trait and has transmitted them to the given child.

Theoretically, overdominance could mean that the trait in the child exceeds that in the parent in which it is highest, and this phenomenon may be called positive overdominance. The trait in the progeny may, however, be less pronounced than in the parent in which it is weakest, and then we are dealing with negative overdominance.

In the first phase of our investigations we found that the traits which develop mainly in the postnatal period (that is, which develop to over 50 percent of the adult value) show heterosis, whereas the head circumference, which develops to 50 percent of its final value in the fetal period, shows no such effect (Wolański et al. 1970).

Closer studies demonstrated that the two theoretical possibilities of positive and negative overdominance actually exist. The measure of heterosis used in this case was the percent by which the value of the given traits in children from exogamous families exceeds the value in children from endogamous families. Families were considered to be exogamous if the spouses originated from different villages and to be endogamous when both parents came from the same locality. The degree of development in the fetal period was measured by the value of the trait in the newborn (as a control, this value was compared with the value for children at the ages of one and three years) expressed as a percent of the same value in an average adult of the same sex. The difference between this value and 100 shows the percent of development in the postnatal period. According to this method, the following traits were determined: body weight (percent of development in postnatal period 95 percent, degree of heterosis 3.3 percent), Quetelet index (82 percent and 1.2 percent), stature (71 percent and 1.2 percent), shoulder width (70 percent and 0.7 percent), parieto-heel length (65 percent and 1.7 percent), nose height (62 percent and 0.2 percent) shown in Table 5, chest circumference (61 percent and 1.2 percent), total face length (59 percent and 0.0 percent), chest depth (55 percent and 1.4 percent), mandible width (55 percent and −0.8 percent), minimum forehead width (45 percent and

Table 5. Nasal height (n-sn) in mm in offspring of parents with different mean matrimonial radius (MMR)

	Group A: MMR = 0 km				Group B: MMR = 1–10 km				Group C: MMR = 11 km or more				Student's *t* test between		
Age in years	$\bar{x}$	s.d.	E_{-x}	*n*	$\bar{x}$	s.d.	E_{-x}	*n*	$\bar{x}$	s.d.	E_{-x}	*n*	AB	AC	BC
Males															
1.5–3.4	35.14	4.259	1.739	7	*40.33*	4.163	2.944	3	34.80	2.588	1.294	5	1.59	0.15	2.01[a]
3.5–5.4	38.75	4.027	1.522	8	*39.67*	2.338	1.046	6	39.14	4.598	1.877	7	0.46	0.16	0.23
5.5–7.4	42.18	2.786	0.881	11	43.83	2.855	0.861	12	42.09	3.618	1.144	11	1.34	0.06	1.23
7.5–9.4	*45.88*	2.736	0.684	17	45.47	2.875	0.768	15	45.21	4.117	1.142	14	0.41	0.52	0.19
9.5–11.4	45.61	3.238	0.785	18	*47.92*	3.269	0.682	24	45.60	3.950	1.317	10	2.22[b]	0.01	1.71[a]
11.5–13.4	47.10	4.657	1.041	21	47.58	3.396	0.679	26	*48.91*	3.646	1.153	11	0.40	1.09	1.04
13.5–15.4	49.76	4.134	0.924	21	50.50	2.338	0.604	16	*53.44*	4.096	1.448	9	0.62	2.17[b]	2.19[b]
15.5–19.9	53.70	4.319	0.991	20	*53.92*	3.844	0.802	24	53.91	5.752	1.819	11	0.17	0.11	0.00
20.0–29.9	*55.50*	5.446	1.510	14	54.09	2.663	0.842	11	54.00	3.082	1.541	5	0.76	0.55	0.06
30.0–49.9	56.90	3.726	0.855	20	57.15	5.696	0.924	39	*59.29*	7.620	1.466	28	0.18	1.27	1.29
50.0–69.9	*60.60*	4.278	2.139	5	57.04	3.507	0.731	24	55.50	3.659	1.220	10	1.91[a]	2.24[b]	1.12
70.0–99.9	0.00	0.000	0.000	0	55.00	0.000	0.000	1	0.00	0.000	0.000	0	0.00	0.00	0.00
Females															
1.5–3.4	*37.00*	5.657	5.657	2	35.20	3.564	1.782	5	34.82	6.210	1.964	11	0.43	0.43	0.12
3.5–5.4	37.54	3.017	0.871	13	38.73	4.452	1.408	11	*40.43*	2.440	0.996	7	0.74	2.07[a]	0.87
5.5–7.4	40.88	3.982	0.996	17	*44.33*	3.352	0.896	15	40.44	3.206	1.133	9	2.55[b]	0.27	2.68[b]
7.5–9.4	44.00	2.663	0.803	12	*46.13*	3.563	1.347	8	46.00	8.781	2.927	10	1.45	0.71	0.04
9.5–11.4	46.42	3.189	0.665	24	46.11	4.898	1.188	18	45.22	4.549	1.608	9	0.24	0.82	0.44
11.5–13.4	47.21	4.063	0.958	19	*48.47*	2.452	0.613	17	48.44	4.035	1.426	9	1.08	0.72	0.02
13.5–15.4	49.15	5.460	1.576	13	*50.89*	3.724	0.903	18	50.80	1.874	0.625	19	1.02	0.87	0.07
15.5–19.9	51.63	4.177	1.079	16	52.24	3.345	0.836	17	*54.43*	3.599	1.469	7	0.45	1.47	1.37
20.0–29.9	52.08	8.262	2.491	12	53.74	4.372	0.932	23	50.75	4.334	1.638	8	0.75	0.40	1.61
30.0–49.9	*53.88*	6.375	1.329	24	53.17	5.122	0.800	42	53.40	3.041	0.621	25	0.49	0.33	0.20
50.0–69.9	48.75	4.573	2.640	4	*53.40*	4.195	1.398	10	46.00	0.000	0.000	1	1.69	0.00	0.00
70.0–99.9	50.00	0.000	0.000	1	0.00	0.000	0.000	0	0.00	0.000	0.000	0	0.00	0.00	0.00

Legend: 50.89 = maximal value.

[a] Difference significant at 0.01 level.

[b] Difference significant at 0.05 level.

0.4 percent), face width (43 percent and −0.7 percent), head width (40 percent and −0.6 percent), head length (39 percent and 0.7 percent), head circumference (36 percent and 0.0 percent), nose width (36 percent and −1.0 percent), and cephalic index (1.3 percent and −1.2 percent). The above enumerated relationships are presented in the form of a regression line in Figure 4. As seen in this figure, those traits which achieve more than 55 percent of adult values in the postnatal period show positive heterosis, whereas those (mainly head, face, and nose width) which attain the bulk of their adult value (more than 55 percent) in the fetal period show an effect which might be called negative heterosis. This conclusion holds true under good living conditions (a well-fed population).

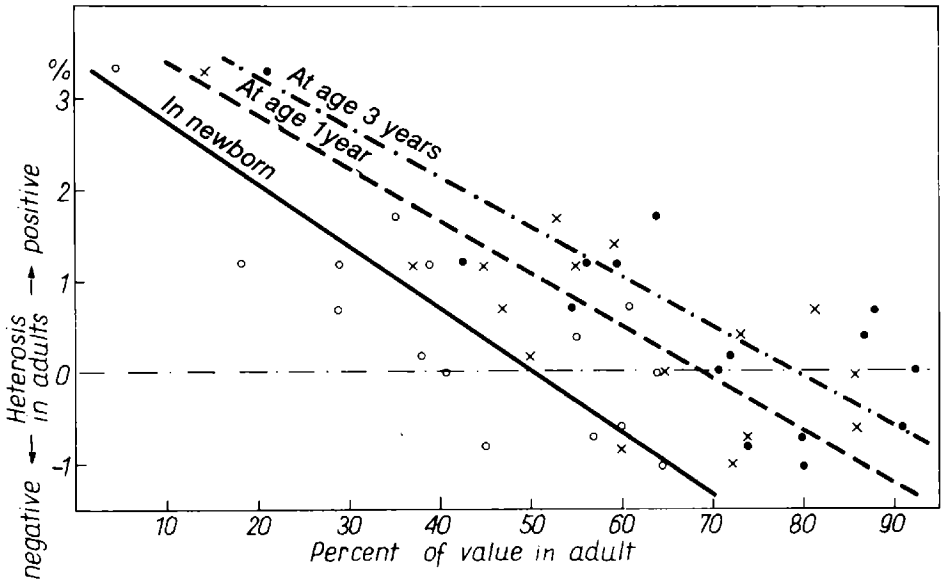

Figure 4. Trait values in percentages in offspring from exogamic parents compared with the values of the same traits in progeny from endogamic mating, against the trait proper to the newborn as percent of the trait in adults (Wolański 1972)

Under the conditions of a population with a relatively high standard of living, children of parents with discordant stature categories, some of which are shown in Figures 5 and 6, are taller than children living under similar conditions both of whose parents are of medium stature. It may be assumed that heterozygotic children are more sensitive to advantageous living conditions, including better nutrition. The similar results connected with children from exogenous families (small marital radius) was found in several series of investigations (e.g. Hulse 1957; Nolde 1963; Ferak et al. 1968; Schreider 1969).

Under the conditions of undernourished populations with a low standard of living, it was found that children of parents in discordant stature categories, some of which are shown in Figure 7, are smaller than those

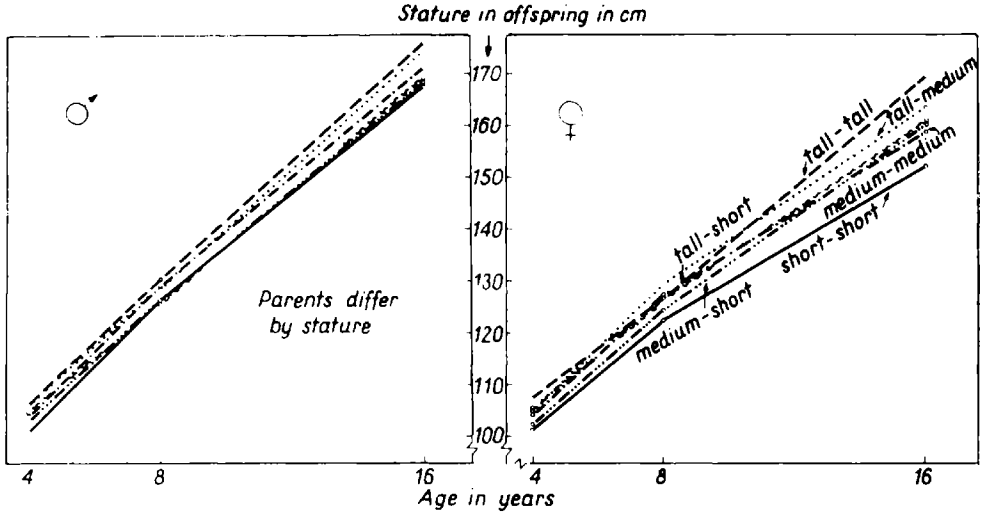

Figure 5. Stature in offspring aged four, eight, and sixteen years in urban (Szczecin) families in which parents differ by assortative mating according to stature; tall–tall = both parents tall, medium–medium = both parents of medium stature, short–short = both parents short; and various groups: tall–short, tall–medium, medium–short

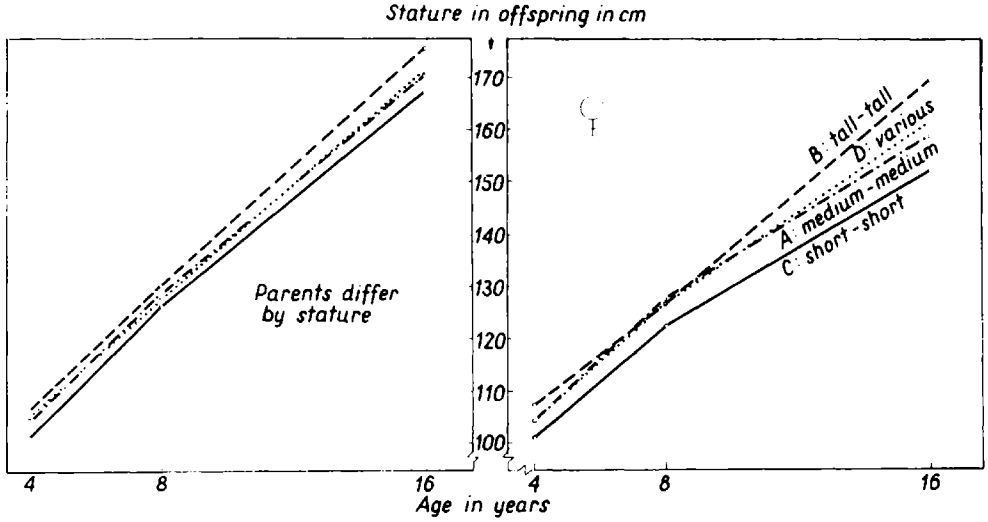

Figure 6. Stature in offspring aged four, eight, and sixteen years in urban (Szczecin) families in which parents differ by assortative mating according to stature. Groups as in Figure 5, but various groups not differentiated

both of whose parents are of medium stature. It would perhaps thus seem that heterozygotic children are more sensitive to food deficiency (expressed in a reduction of stature) than children homozygotic for the given trait, under the same living conditions.

From this problem of nutritional status two essential conclusions can be drawn: (1) heterozygotic organisms are more prone to the influence of environmental factors (in the given case of nutrition); and (2) in popula-

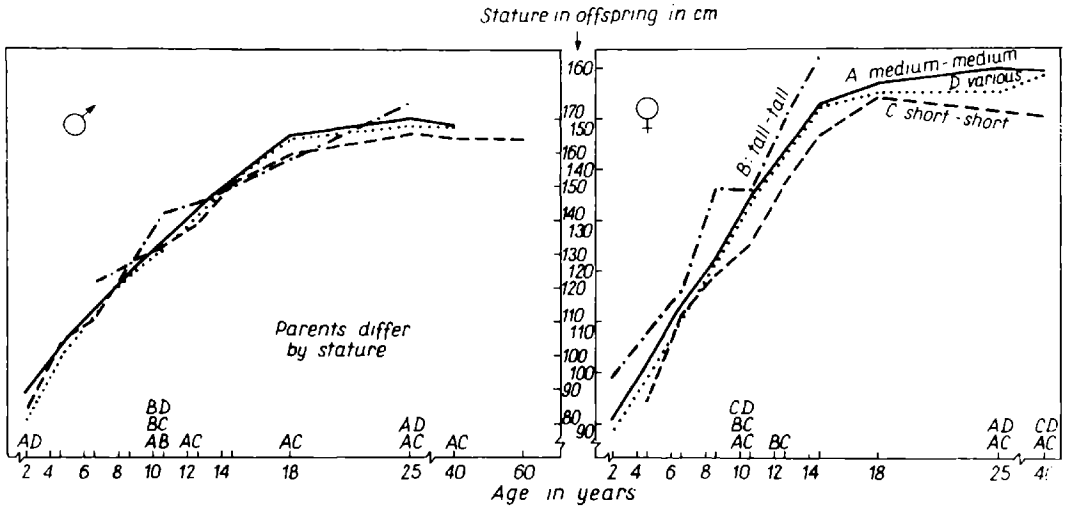

Figure 7. Stature in offspring aged eigtheen months to seventy years in rural families in which parents differ by assortative mating according to stature. Groups as in Figure 5 (various = three heterogenous groups)

tions in which there is a greater tendency to crossbreeding or outcrossing, individuals who are heterozygotes for the traits under investigation will undergo the influence of the given mode of nutrition to a greater extent; and the more numerous such individuals are the stronger will be the effect of nutrition on the given population, both in the case of undernutrition and in that of plentiful nutrition (including rational or incorrect nutrition).

In rural populations (and poorer social strata) there is less mobility (migrations and matrimonial radius), so that there is potentially a greater chance of homozygosis. Their traits will be therefore less deflected by the influence of ecological conditions than those of urban populations whose mobility is greater. They have a greater frequency of heterozygotes (let us call them heterogenous populations), the traits of which can be more easily altered by the conditions of the external environment. In other words: heterozygotes are more sensitive to both inciting stimuli of the environment and those which act as inhibitors of development. That is why heterozygous individuals and populations heterogenous from the point of view of the given trait will react more strongly to a stimulus which is the same by its force and duration (e.g. a nutritional stimulus). Thus, the given level of development of traits on the basis of which we used to assess the nutritional status may be a result not only of the strength and duration of the stimulus, but also of the sensitivity (greater in individuals heterogenous under the angle of the given trait) of the body to the given stimulus.

In order to further elucidate this phenomenon, more than 570 three-generational families were investigated in farming villages of Suwałki

(Białystok District) and Ostrołęka (Warsaw District) counties. These areas were isolated for several hundred years by the state frontiers and the geographic situation (forests and swamps in Ostrołęka county and forests, lakes, and hilly terrain in Suwałki county). The number of inhabitants in the individual villages varies from 100 to 600; the entire isolated population within the parish limit comprises three to eight thousand subjects. The mean mating radius (MR), calculated as mean distance between the places of birth of the spouses, is 6.4 km. From among the numerous traits examined, sixty-four were taken into account, as listed in Table 6, characterizing various somatic, physiological, biochemical, and psychomotor properties. The age of the persons examined varied from eighteen months to ninety-six years; for the parent generation it amounted to between nineteen and sixty-nine years, for the grandparents between forty-seven and ninety-six years. A total of more than eleven thousand subjects was examined, and for the present analysis, data for almost four thousand were used. The results of the final calculations are compiled in 448 tables, of which Table 5 serves as an example. Thus we discuss here only the synthetic conclusions based on these tables.

Table 6. Traits showing in offspring distinct (++) or weak (+) positive heterosis, and distinct (−−) or weak (−) negative heterosis, connected with various systems of classification of their parents (discussed in the paper)

Traits under study	ABO groups	Mating radius	Rh groups	Stature	Facial index	Hair and eye color
Stature (B-v)		++		−−		+
Skinfold thickness	++		+	+		
Trunk length (sst-sy)					−	
Upper extremity length (a-da)		+	−	−−		+
Shoulder breadth index	−−	+	+	++		
Hip breadth index	+	++				
Hand length (sty-da)	+	+	+		+	
Hand breadth (mr-mu)	+	++		−		
Foot length (pte-ap)	+	++	++	−		++
Foot breadth (mtt-mtf)	++	++	++	−	+	
Head length (g-op)		++		−−		
Cephalic index		+				
Total facial height (n-gn)		++				+
Nasal height (n-sn)	−	++			++	++
Minimal frontal breadth (ft-ft)		+	+			−
Mandibular breadth (go-go)		+	+	−−		+
Total facial index		+	+		+	++
Upper facial index			+			++
Interocular breadth (en-en)	++	+				
Total ear height (sa-sba)		++				
Upper ear height (sa-in)		+	++			−

Traits under study	ABO groups	Mating radius	Rh groups	Stature	Facial index	Hair and eye color
Ear breadth (pa-pra)		+	++			
Ear height index	+	−	++	−−		−−
Ear breadth index		−	++			++
Haptoglobin level		+	+		+	
Lactate dehydrogenase (LDH)		+	++	+		
Malate dehydrogenase (MDH)			++	+	+	
Alkaline phosphatase (AP)	−−			−−		
Aldolase (FDPA)						
Aspartic aminotransferase (AspAT)		+			−	
Alanine aminotransferase (ALAT)				++		
Systolic blood pressure	−	++				++
Diastolic blood pressure	−	++			+	++
Grip strength, right hand	−−	−				
Grip strength, left hand		−			+	−
Shoulder strength			−		+	
Back lift strength		+		−−		+
Hanging, per time						
Running high jump						
Sargent vertical jump						
Medicine ball throw						
Palant ball throw						
Pulse increase after step test						
Maximal oxygen uptake			++		+	
Spine flexibility	−−		+	−−	−	−
Dashes 40/60 m	++			−−	+	++
Reaction time, optical stimulus	++	−	−	++		−−
Reaction time, acoustic stimulus		−	−	−		−−
Reaction time, tactile stimulus		−	−			−−
Agility run, 1 cycle	++		−	+	+	
Agility run, 3 cycles					+	++
Burpee squat-thrust test						−−
Turning balance, per time					+	−
Walking balance test				+		−−
Turning balance test					+	−−
Coordination eye–nerve –muscles, right hand	−					−−
Coordination left hand	−	−−		+		−−
Coordination, per time, right hand		−		−	+	−−
Coordination, per time, left hand		−	++	−	+	−−
Movement accuracy, 120° right hand	++	+		+	−	−−
Movement accuracy, 120° left hand		+	−			−−
Movement accuracy, 60° right hand	++	+		+		
Movement accuracy, 60° left hand		+		+		

The children from the families examined (the children were considered the progeny of the parent generation, and the parents as the children of the grandparent generation) were separated into age classes according to the categories for the marital couples. These categories were established in six classification systems:

System 1. division into three groups according to the distance between the birthplaces of the parents (mating radius, or MR): from the same locality; from localities one to ten km apart; from localities more than eleven km apart.

System 2. division into two groups according to blood groups of the ABO system: both parents have the same phenotypically recognizable blood group, i.e. A or B or O or AB; they have different blood groups.

System 3. division into three groups according to blood groups of the Rh system: both parents have the same blood group; the father has Rh^+ and the mother Rh^-; the father has Rh^- and the mother Rh^+.

System 4. division into two groups according to hair and eye color: both spouses have dark hair and dark eyes; all other possible combinations (it was known beforehand that there was only one family in which both spouses had fair hair and light-colored eyes, and this family was excluded in the calculations).

System 5. division into four groups according to stature: both spouses of moderate stature (according to respective sexes); both spouses tall; both spouses short; all other possible combinations.

System 6. division into four groups according to morphological facial index: both spouses mesoprosopus; both spouses leptoprosopus (narrow-faced); both spouses euryprosopus (wide-faced), all other possible combinations.

We assumed that System 1 would show the differences in gene pools and also the physiological differences resulting from different biogeographic conditions. System 2 was to present the biochemical differences, and System 3 the consequences of selection directed against the children of a mother with Rh^- and father with Rh^+ (erytroblastosis fetalis). Systems 4 and 6 were intended to show racial (typological) differences. System 5 was to show the differences resulting from the size of the body which, together with stature, influences other body dimensions, particularly the longitudinal ones.

All the data were separated into twelve age groups (as shown in Table 5) and, dependent on the division into groups within the particular systems, one (Systems 2 and 4) to five (Systems 5 and 6) intergroup differences were obtained. In order to establish which system gave the best results the following procedure was applied: the differences were examined statistically by Student's t test for groups with unequal numbers of individuals; then the number of statistically significant differences was expressed as a percentage of all differences and arranged according to age classes, as

shown in Figures 8 and 9. From among the five systems tested in this way, Systems 5, 3, 1, and 4 (stature, Rh blood group, marital radius, and hair and eye color) show the differences best. It could be additionally demonstrated in the analysis (for lack of space, several hundred relevant tables cannot be shown here) that from among the three differences proper for the mean mating radius, the one characterizing the offspring of a given couple is whether both spouses were born in the same locality (endogamous mating) or in different places (exogamous mating). The classification into groups one to ten km distant and eleven or more km distant proved unnecessary. The third system effective in distinguishing the children was the system dividing parent couples according to their Rh blood groups, shown in Figure 10. In this case the differences are better revealed when the couples are classified into those in which both have the same Rh group and those in which the husband has Rh^- and the wife Rh^+. No major differences were found between the last named combination and the situation in which the husband has Rh^+ and the wife Rh^-. This may be due to the higher mortality (Table 4) of children of parents with Rh^+ fathers and Rh^- mothers. Classification of children into groups according to the mating of their parents as regards stature and the morphological facial index (Systems 5 and 6) is of minor importance, since only a few traits and the childhood age classes show statistically significant differences (Figures 8 and 9). With regard to both stature and the morphological facial index, wider differences occur between children of

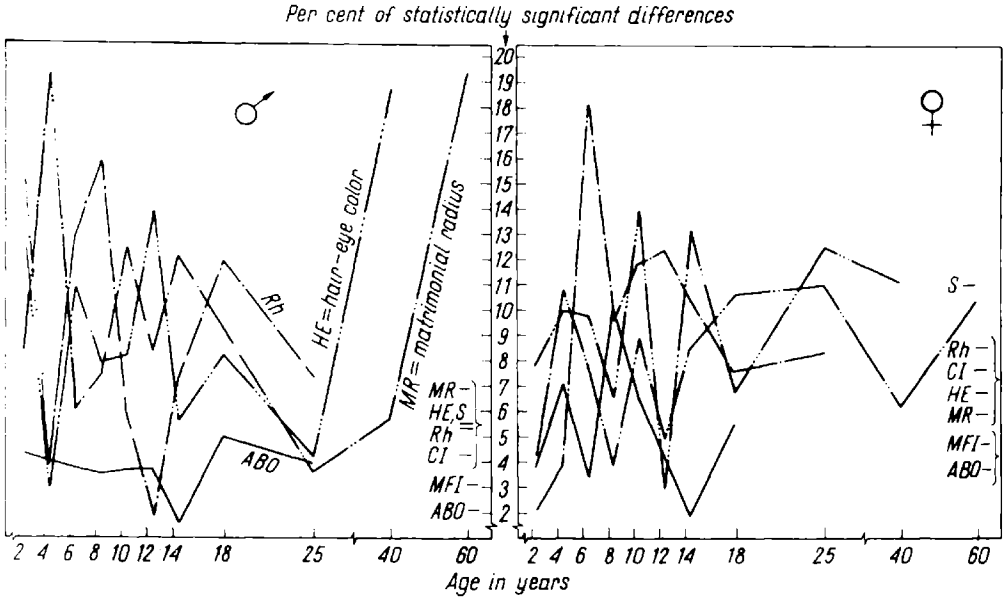

Figure 8. Percent of statistically significant differences with reference to all differences analyzed between children from heterogenic and homogenic mating, distinguished according to the mean matrimonial radius (MR), hair and eye color (HE), ABO blood group (ABO), and Rh system (Rh). The percent of differences is given for progeny aged two to sixty years. On the right, mean values

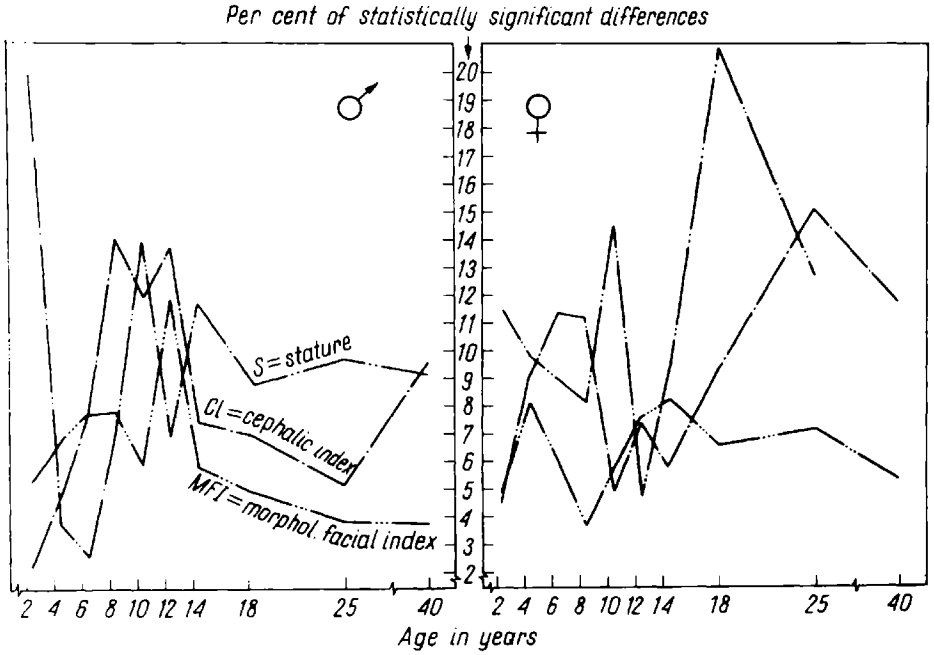

Figure 9. Percent of statistically significant differences with reference to all differences analyzed between children from heterogenic and homogenic mating, distinguished by stature, cephalic index, and morphological facial index. Mean values are given in Figure 8

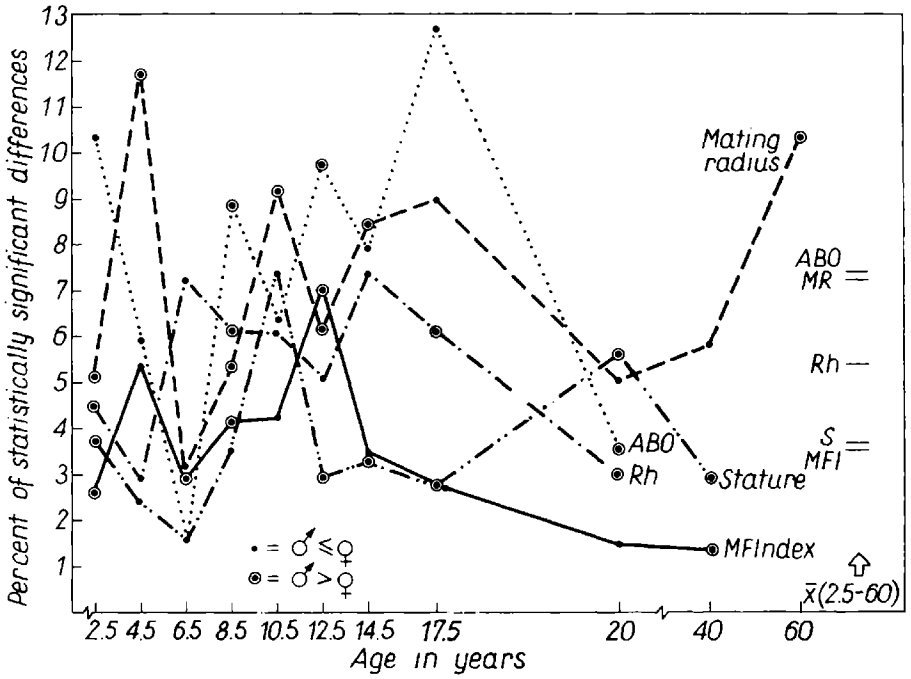

Figure 10. Percent of statistically significant differences with reference to all differences analyzed between children from heterogenic and homogenic mating, distinguished according to the mean mating radius (MR), ABO blood group (ABO), Rh system (Rh), stature (S), and morphological facial index (MFI). The percent of differences is given for progeny aged thirty months to sixty years.

couples in which both the husband and the wife are of moderate stature (or show a medium facial index) than couples in which the spouses differ from one another by stature (or facial index). The differences between the children are smallest in groups in which both parents are tall (or have a long narrow face) compared with those whose parents are short (or have wide faces). This may perhaps result from the phenomenon known as regression toward the arithmetical mean of the population.

The average percent of statistically significant differences in relation to all the differences calculated for children (the groups being based on the characteristics of the parents) is as follows (see also Figures 8 and 9): according to the blood groups of the ABO system, 4.5 percent; according to morphological facial index, 6.4 percent; according to the cephalic index, 8.7 percent; according to hair and eye color, 8.9 percent; according to mating radius, 9.1 percent; according to Rh blood group, 9.2 percent; and according to stature, as much as 10.3 percent.

The widest differences between children as regards the above average percent of significant differences occur at the age of about nine to thirteen years (puberty); they are, however, noticeable at the ages of seven to eight and eighteen to twenty-five (Figures 8 and 9). As far as these differences can be interpreted as due to heterosis or homosis, it appears that these effects become enhanced with age, particularly between the sixth and fifteenth year of life (around puberty), but also in the prepubescent periods. This effect becomes most pronounced if we classify the parents according to Rh blood-group system, stature, or mating radius.

From the previously mentioned 448 tables analogous to Table 5, the following conclusions can be drawn (Table 6): most longitudinal dimensions of the body and head (e.g. nose length: Table 5), relative hip breadth, hand and foot dimensions, thickness of the subcutaneous fat-tissue layer, haptoglobin level, activity levels of LDH, MDH, and ALAT, maximal oxygen uptake, and agility and movement accuracy show higher values in children from heterogenic families. The latter comprise all those families in which the spouses originate from different localities (exogamous mating), had different blood groups, or differed by the color of hair and eyes, stature (respective for the sexes), or shape of the face. Families in which the parents originate from the same locality (endogamous mating) or have similar blood groups, hair and eye color, or stature and shape of face will, therefore, be referred to as homogenous. In this connection the effect discussed above may be called positive heterosis (overdominance or high hybrid vigor). It should be stated here that if we use such notions as high hybrid vigor and if we take into account as a positive effect larger somatic dimensions and a higher enzyme activity, we should also consider as such a shorter sprint time or agility run and a smaller number of errors in the test for accuracy or coordination of movements.

In general, lower values (or a longer reaction time, etc.) are observed in

children from heterogenous families as regards the AP activity level, grip strength of hand, spine flexibility, simple reaction time for acoustic and tactile stimulus, and Burpee test for agility and endurance. These effects may be called negative heterosis — but we must remember the conclusions from Figures 4 through 7. The question for future research is, which traits show, under conditions of good nutrition, negative and which positive effects of heterosis; which show analogous and which reciprocal effects, as in Figures 5 through 7.

Controversial results — higher or lower values depending on the system of parent classification — were obtained for children when testing the following traits (Table 6): length of upper extremities, head length, shoulder width, mandible width, ear height index, AspAT activity, systolic and diastolic pressure, shoulder strength, back lifting strength, 60 m dash, simple reaction time for optical stimulus, balance, and movement coordination and accuracy.

These findings may be explained in two ways: some properties of the parents (somatic or blood-group) may not be in any way associated with the traits investigated in the children, whereas other traits may exhibit such association (of course we have no grounds for speaking of genetic linkage). For instance, children of dolichocephalic (long-headed) parents, a trait important in racial diagnostics, may show other types of association than do children of short-headed parents; or children with blood group A may have different association types than those with group B. In view of this, particular couples considered by us as heterogenous in reference to one system of classification (e.g. according to the ABO blood group) may not be heterogenous from the point of view of hair and eye pigmentation and so on. This in turn will influence our results concerning the phenomenon of heterosis in the progeny.

The results obtained validate to some extent the conclusion advanced in connection with Figure 4. We have devised on the basis of expected results and our investigations a model which allows one to predict the degree of heterosis, shown in Figure 11. From this graph a very important hypothesis results, that heterosis will always be "centripetally" directed. This can be explained as follows: it results from the extrapolation of the lines of development in the fetal period that the traits which before birth develop to above 50 percent of the normal adult values are further "inhibited" in development and show a certain retardation (as far as we know, this is true under conditions of good nutrition). On the other hand, those traits which develop slowly in the prenatal period show an acceleration of development in the postnatal period. The direction in which heterosis acts agrees with this tendency. Traits which "should" develop more slowly after birth are retarded by heterozygosis. If homosis is the opposite of heterosis, one might suppose that the latter is a stabilizing and unifying factor in developmental tendencies, whereas homosis acts "cen-

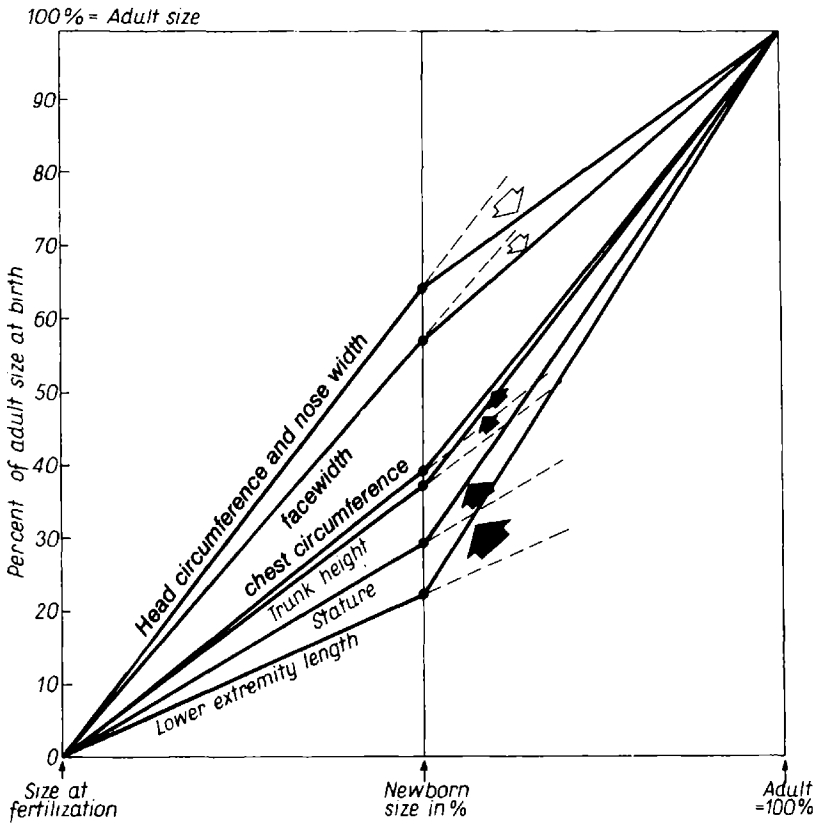

Figure 11. Theoretical model based on true values of the traits reached by newborn infants with reference to the values for adults, assumed as 100 percent. The arrows indicate the direction of action of heterosis, which is in agreement with the "centripetal" tendency with regard to the rate of development specific for the given trait in the fetal period

trifugally" and disturbs the course of development. A free comparison might be useful here in connection with the paper by Pyżuk and Hanc (1972) concerning the influence of the occurrence of myelomeningocele on the development of particular body segments. Such damage causes a reduced development of the lower extremities with simultaneous enlargement of the hand. The direction of changes described by us as probably caused by homosis seems a result of the lack of reduction of the rate of development specific to the embryo and fetus. Further investigations will demonstrate whether this occurrence is accidental (Wolański 1974b).

The phenomena of heterosis and homosis seem to be one of the important mechanisms of development of organisms and populations, a problem which undoubtedly deserves further research.

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Geographic Distribution of the Haptoglobin Groups in Greece

M. PAIDOUSIS and N. XIROTIRIS

This study, a statistical analysis of the results of our own research to date, as well as of the work done by other researchers, constitutes part of our more extensive research project on the Greek population. So far, 8,909 individuals from various geographic areas have been examined by different researchers for the frequency and distribution of phenotypes of the haptoglobin groups. Although the number of individuals cannot be considered sufficient, we are nevertheless able to form a general picture of the pattern of distribution of the Hp genes among the Greek population.

Table 1 shows the distribution of the Hp genes (5,096 individuals) by geographic area. Tables 2, 3, and 4 show the results of the comparison of the distribution of the frequencies of the Hp^1 genes over larger geographic areas (see References).

As these tables show, the distribution of the Hp^1 genes by geographic area does not show a statistically significant difference.

Generally speaking, the frequencies recorded for the Hp^1 genes are within the limits of those for southeastern Europe. Thus, the tendency of diminishing gene frequencies from west to east is verified. This general tendency is not noted when the distribution of Hp^1 genes is being examined by geographic area. The lowest frequency of the Hp^1 genes was noted in a (not representative) pattern sample from Cyprus (0.227), while the highest frequency was recorded in the isolated population of Sfakia on Crete (0.370). The remaining frequencies can be classified into four groups: (1) Crete (excluding the area of Sfakia); (2) Peloponnesus, Thessalia, Macedonia, Dodecanese; (3) Epirus, central Greece, Thrace (particularly the Pomacs); (4) Attica, Athens (this pattern sample is not representative because the population of this area derives irregularly from other geographic areas).

The recorded differentiation is generally in accord with the usual

pattern of distribution of the ABO groups and probably also reflects in some way the distribution of the two main anthropological types in Greece, the Mediterranean (groups 1 and 2) and the Dinaric (group 3).

Although some research progress has been achieved in Greek territory, the basic anthropological make-up of the population remains essentially unknown, with the result of incomplete or even erroneous evaluation of the data recorded.

Table 1. Distribution of Hp genes by geographic area

Geographic area	Number of Hp^1 genes	Number of Hp^2 genes	Total number of genes	Frequency of Hp^1
Macedonia	460	934	1,394	0.330
Thessaly	348	696	1,044	0.333
Thrace/Pomacs	381	679	1,060	0.359
Epirus	129	239	368	0.351
Central Greece	746	1,386	2,132	0.350
Attika/Athens	500	868	1,368	0.365
Peloponnesus	347	741	1,088	0.319
Crete	217	493	710	0.306
Dodecanese/Rhodes	128	268	396	0.323
Cyprus	89	305	394	0.226
Total	3,345	6,609	9,954	0.3360

Note: $\chi^2 = 36.454$ (9d.f.); $P < 0.001$.

Table 2. Distribution of Hp genes in northern area

Geographic areas	Number of Hp^1 genes	Number of Hp^2 genes	Total number of genes	Frequency of Hp^1
Macedonia	460	934	1,394	0.330
Thessaly	348	696	1,044	0.333
Thrace/Pomacs	381	679	1,060	0.359
Epirus	129	239	368	0.351
Total northern area	1,318	2,548	3,866	0.3409

Note: $\chi^2 = 2.778$ (3 d.f.); no significance.

Table 3. Distribution of Hp genes in southern area

Geographic areas	Number of Hp^1 genes	Number of Hp^2 genes	Total number of genes	Frequency of Hp^1
Central Greece	746	1,386	2,132	0.350
Attica/Athens	500	868	1,368	0.365
Peloponnesus	347	741	1,088	0.319
Total southern area	1,593	2,995	4,588	0.3472

Note: $\chi^2 = 5.925$ (2 d.f.); no significance.

Table 4. Distribution of Hp genes by large geographic area

Geographic areas	Number of Hp^1 genes	Number of Hp^2 genes	Total number of genes	Frequency of Hp^1
Northern area	1,318	2,548	3,866	0.341
Southern area	1,593	2,995	4,588	0.347
Crete	217	493	710	0.306
Dodecanes/Rhodes	128	268	396	0.323

Note: $\chi^2 = 5.291$ (3 d.f.); no significance.

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Serological Studies of the Pomacs

N. XIROTIRIS

We collected data on the ABO and Rh-Hr blood groups from 1,030 subjects from various villages of the region north of Xanthi, inhabited by the Pomacs. Our results are shown in Tables 1 through 6.

We found that the frequency distribution of the ABO blood groups is of the usual type: O = 44.8543 percent; A = 42.8155 percent; B = 9.5145 percent; and AB = 2.8155 percent. From a statistical point of view, this demonstrates no significant tendencies among the inhabitants of the various villages. Our data show the following mean distribution of genotypes: r = 0.66973; p = 0.26658; q = 0.06761.

The population of the village of Oraion must be considered as the most isolated according to the group frequencies. It is statistically demonstrable that the probable relationship with the Greeks is equal to 30 to 50 percent, and the relationship with several villages to 50 to 70 percent, the difference resulting from the low B and AB frequencies among the Pomacs. There is almost no probability that they are related to the frontier populations to the north or east. The frequency of the subgroup A_1 reaches a level equal to that of the European type, while that of the subgroup A_2 is reduced.

In studing the Rh-Hr system, we found the rare genotype CDe/cDe analogous to 54 percent; other genotypes have a higher frequency than usual in Europeans, while some are not found at all. The percentage of Rh negative individuals is slightly higher than that among the Greeks.

Small differences are also found in the expected analogies of the Rh system among homozygotes and heterozygotes.

On the basis of various linguistic, folkloristic, and archaeological discoveries, as well as the specific blood chemistry, we arrive at the conclusion that the Pomacs are of one racial type which has not received foreign influences and which has been isolated for a considerable time because of its physical distance from the tendencies which have modified the blood

chemistry of the rest of the Greeks. Inbreeding has preserved very low frequencies of the B group and rather high frequencies of the A group and has maintained certain rare genotypes.

While it is certain that we cannot classify a population as belonging to a specific anthropological group on the basis of a single anthropological characteristic (such as blood groups), we can, however, discover its differences from surrounding populations and deduce their probable relationship and the influences which have resulted from the relationship.

Table 1. Distribution of phenotype frequencies of the ABO system

	n	O	A	B	AB
Echinos	309	43.0420	42.3948	11.0032	3.5598
Satrai	98	42.8571	41.8367	11.2244	4.0863
Oraion	293	46.0750	43.6860	8.1912	2.0477
Melivoia	178	46.0674	42.6966	8.9887	2.2471
Kotyli	152	46.0526	42.7631	8.5526	2.6315
Σ	1,030	44.8543	42.8155	9.5145	2.8155

Table 2. Distribution of the genotype frequencies of the ABO system

	r	p	q	r+p+q	D
Echinos	0.65606	0.26825	0.07909	1.00341	0.00341
Satrai	0.65465	0.26563	0.08074	1.00104	0.00104
Oraion	0.67878	0.26863	0.05786	1.00529	0.00529
Melivoia	0.67872	0.26341	0.06326	1.00541	0.00541
Kotyli	0.67862	0.26380	0.06033	1.00275	0.00275
Σ	0.66973	0.26658	0.06761		

Table 3.

	σ_D	D/σ_D	EP_D	D/EP_D
Echinos	0.00713	0.47798	0.00481	0.70864
Satrai	0.01273	0.08178	0.00858	0.12124
Oraion	0.00620	0.85316	0.00418	1.51371
Melivoia	0.00823	0.65745	0.00555	0.97472
Kotyli	0.00869	0.31693	0.00586	0.46983

Table 4.

	n	Rh(D+)	Rh(D−)
Echinos	309	87.6956	12.2968
Satrai	98	87.7544	12.2448
Oraion	293	84.9837	15.0172
Σ	700	86.5974	13.4326

Table 5. Distribution of Rh gene complex among 200 subjects from Oraion

Gene	Frequency
CDe	0.360
cDE	0.090
cDe	0.350
Cde	0.015
cdE	0.000
CDE	0.060
cde	0.125

Table 6. Distribution of phenotype frequencies of the A_1 and A_2 blood groups

n	A_1	A_2	AB	A_2/aA_1
150	40.76	1.70	–	0.0419

SECTION TWO

Prehistoric Populations

The Fossil Man from the Sunghir Settlement and His Place Among Other Late Paleolithic Fossils

V. V. BUNAK

THE LATE PALEOLITHIC SETTLEMENT OF SUNGHIR

In 1955, during excavations in a clay quarry on the outskirts of the city of Vladimir, in a place called Sunghir after the brook flowing there, fossil bones and stone and bone artifacts were found. They were sent to the museums of Vladimir and to the Institute of Archeology of the U.S.S.R. Academy of Sciences. In 1956, Bader found a culture stratum there, whereupon systematic excavations were launched in Sunghir. In the fifteen years following 1957, an area of over three thousand square meters was opened; in 1964 a grave was found, and in 1969 another one was discovered, three meters from the first grave. In the first grave, under three meters of supermoraine loam, in the second layer from the top and under the culture stratum, an oval depression was found, on the bottom of which a human skeleton was stretched on its back with its head pointing in a northeasterly direction. The grave was filled with a great quantity of ochre. Rich ornaments were found on the skeleton: mammoth-tusk bracelets, bracelets made of drilled pebble, and over three thousand beads also made from mammoth tusks. In the richness of its funeral ornaments, particularly those on the skeletons in the second grave, the Sunghir find surpasses all other known Late Paleolithic burials. Above the first burial, ill-preserved remains of a woman's skull were found; above the principal burials in the second grave were the remains of the skeleton of an adult.

The artifacts found in the settlement consist of tooled flints and bone and burin tools. The preponderance of scraper- and chisellike tools and the technique of processing indicate, according to the experts, that the flint techniques at this settlement were quite archaic. A distinctive feature of the Sunghir settlement is its abundance of endpieces with a concave

base. The scholars have found many common features of flint-working technique linking the Sunghir and the early Kostenki settlements on the river Don. On the strength of this, one can speak of a single Kostenki–Sunghir culture coming under the general heading of forms of the Seletsko–Pavlovo culture of central Europe. The geological aspect of the Sunghir find was discussed by a special committee of experts (Bader et al. 1966). The dates were established as somewhere between the Valdai glaciation and the Ostashkov time, or W½–W3. The absolute age determined by the radioactive C^{14} technique on the latest specimens is, according to Bader, 24,000 years.

The natural environment of Sunghir man was a grassy plain with isolated copses, predominantly of spruce, birch, and, less frequently, pine trees. The larger mammals included small reindeer, horse, mammoth, and polar fox; the principal small mammals were Norwegian lemming and hoofed lemming. That the climate was arctic is indicated by the clothing of the Sunghir man as reconstructed by Bader.

Skeleton number 1, two interesting skeletons from grave number 2, and the incomplete woman's skull from grave number 1 are presently being studied. We are concerned here with the results of a comparative study of skull number 1, on which a preliminary report was published by Debetz in 1967.

GENERAL INFORMATION ABOUT THE SKULL

The skull is intact, with only a slight bone shift in the temporal-parietal region and in the front part of the skull base. The minor reconstruction performed by Gerasimov gave the skull an adequately normal shape, with the exception of the basion region. The basion point in the natural state must have been five to eight millimeters lower.

Judging by its size, particularly the size of the mandible, and also by some details of the structure, the skull is male, medium by the degree of bone solidity. In the area of the zygomatic arch, the bone thickness is three to four millimeters. All the sutures are visible as shallow lines, corresponding on the whole to the fourth or fifth degree of knitting, with the exception of the lambdoid suture, which forms a triangular protrusion with serrated bones along the sagittal line. The protrusion is found between the parietal bones, slightly above their surface. The joints of the facial skeleton are indicated only by small furrows; the palatine processes are divided by a slitlike recess. The vomer and alate processes are absent. The teeth on both jaws are fully preserved. The furrow relief on the molar cusps is completely smooth, but the thin enamel layer is developed. No traces of senile bone thinning are found. Judging by the state of teeth and sutures, the age of the Sunghir man is late maturity. The skeleton bone

measurements give the following body build: tall, about 178 centimeters, broad-shouldered, average-length body, and medium-robust, long bones.

The skull bone relief is developed to a medium degree. The superciliary arches are medium in length and spread and do not blend with the upper edge of the eye socket: the zygomatic process of the frontal bone is moderately robust. The upper occipital line is pronounced to a slight degree, the occipital protuberance to a moderate degree; the temporal line is underdeveloped over most of its length but visible over a section from the mastoid process to the tubercular symphysis. Along the sagittal palatine suture there is a slight bulging which, however, does not reach the size of the palatine torus.

The Braincase

The longitudinal diameter is from small to medium; the lateral diameter is from medium to large; and the height diameter (from the porion) is just above medium. In the Late Paleolithic craniological material, only the Solutré skulls are shorter than the Sunghir one, and only the Cro-Magnon skulls are wider. The characteristic according to the indices is moderate mesocrania, ortho-, and metriocrania. The modulus (arithmetic mean of the three diameters) is 150 — a medium value for a male skull. The capacity calculated according to the Pearson–Lee interracial formula is 1,520 cubic centimeters. The contour in the vertical norm is ovoid, with the greatest breadth about the median third of the longitudinal axis; the occiput is uniformly round, the temporal region visibly narrowed. Based on the lateral frontal-parietal index (70) and asterionic-parietal index (77), the Sunghir skull occupies a middle position in the series of the Late Paleolithic variants. On transversal section through the bregma, the walls from the parietal protuberances follow a line close to vertical; the upper portion of the contour forms a visibly bending arch, the bending being more pronounced than in the Cro-Magnon or Předmost skulls. The auricular-parietal index is 90, which is relatively high, and the parietal eminences protrude only slightly.

The superposition of different contours clearly shows an insignificant inclination of the squama frontalis from the glabella to the metopic point, and an uniform and gentle bending of the sinciput which smoothly passes into the squama occipitalis, the latter forming no heellike protuberance, as is the case with the Cro-Magnon and other skulls. For the sake of comparison, Table 1 shows the indices of projection of the skullcap bones: the ratio of the perpendicular from the most protruding point of the bend to the length of the frontal and parietal bone chord, and also to the perpendicular from the union point of the segment between this perpendicular and the most protruding part of the occiput. This index is

Table 1. Comparison of Sungir skull with other Late Paleolithic skulls according to skullcap bone protrusion indices

	Frontal	Parietal	Occipital
Sunghir	26.1	22.0	9.0
Předmost III	19.1	18.5	19.2
Combe-Capelle	26.4	20.8	24
Pavlovo	23.2	24.6	–
Cro-Magnon I	26.4	20.2	17.0

very revealing for occiput contour comparisons; the lower the value of this index, the greater the protrusion of the bones.

The ratio of the projected length of the front (preporion) section to the greatest skull length in the Sunghir skull is equal to 55.2. The distance in a projected plane from the porion to the perpendicular from the frontal-zygomatic temporal point constitutes 94 percent of the preporion length.

The occipital projection of the Předmost III and Combe-Capelle skulls is relatively highly positioned, with the lower squama of the occipital bone being more inclined and rectilinear. The Sunghir skull is distinguished by virtue of a less inclined and less bent contour of the lower squama occipitalis.

The basion–nasion diameter of 88 millimeters given in Table 2 amounts to 47 percent of the skull length, a value far lower than average. This is accounted for by the imprecise determination of the basion point during the reconstruction.

The Facial Section

The arithmetic mean of three diameters — the mean width (zygomaxillar), the alveolar length, and the nasion–alveolon height — serves as the maxillar modulus compatible with the brain-section modulus. The Sunghir maxillar modulus is equal to 79.8 and amounts to 53 percent of the brain modulus, a value close to the average index of the modern races. If, instead of the mean width, the biorbital width is taken, the index values undergo practically no changes, for these two diameters are almost equal. The facial modulus of some other Late Paleolithic skulls is somewhat below 53.

Three segments of the maxillar vertical axis — from the nasion to the projection of the lower edges of the eye sockets; and from this point to the nasospinal point and from the latter to the alveolon — are respectively equal to 38.4 percent and 30.8 percent each. In modern groups, the median segment is most frequently somewhat shortened, whereas the median segment of the Sunghir skull is comparatively large, a fact explained by the great height of the maxilla. The angles of the vertical

Table 2. Measurements of the skull from Sunghir burial ground

Endocranial capacity	1,525
23. Horizontal circumference, maximal	538
24. Transverse arc po–br–po	314
25. Sagittal arc n–o	391
1. Length gl–o	188
2. Length gl–in	187
8. Breadth eu–eu	144
11. Breadth au–au	130
12. Breadth as–as	111
9. Breadth frontal minimal ft–ft	102
17. Height ba–br	123
17. Height ba–br (corrected)	130
20. Height po–br	118
5. Length na–ba	88
47. Face height na–gn	127
48. Face height na–al	78
43. Face breadth fmt–fmt	116
46. Face breadth zm–zm	104
45. Face breadth zy–zy	142
40. Face base length	100
77. Nasomalar angle	143
Zygomaxilar angle	128
72. Face profile angle na–ns	84
73. Face profile angle na–ns	84
74. Alveolar angle ns–pr	74
55. Nose height	56
54. Nose width	27
75. Nasal bones angle	57
75 (1). Nasal bones angle II	23
60. Maxilla alveolar length	56
61. Maxilla alveolar breadth	73
68 (1). Mandibular total length	122
68. Mandibular length go–pg	93
65. Mandibular bicondylar breadth	133
66. Mandibular bigonial breadth	113
70. Mandibular ramus height	74
71a. Mandibular ramus minimal breadth	40
69. Symphision height	39
69 (1). Foramen mentale height	36
69 (3). Mandibular body thickness	11
67. Mandibular anterior breadth	50
Angle infradentale–pogonion	66
Indices:	
Module N N (1 + 8 + 20):3	150
8:1 Cranial	76.6
20:1 Length–auricular height	62.8
20:8 Breadth–auricular height	81.9
9:8 Fronto–parietal transverse	70.8
45:8 Zygo–parietal transverse	98.6
46:43 ZM–fmt	89.7
49:45 Upper facial	54.9
52:51 Orbital	73.6
54:55 Nasal	48.2
61:60 Alveolar	130.4
66:65 Mandibular–angular–bicondylar breadth	85.0

profile, particularly the alveolar, are indicative of mesognathy, found in many skulls of the series under study, particularly the Předmost skulls. The angle of protrusion of the nasal bones is relatively small, only 23°. The angular dimensions of the nose have been determined for only a fraction of the fossil crania, and the Sunghir skull is little different from the general Late Paleolithic mean.

In terms of the greatest zygomatic width, the Sunghir skull approximates the Cro-Magnon group: this diameter constitutes 99 percent of the width of the braincase and characterizes a small-to-medium variant. The alveolar-zygomatic ridge is moderately pronounced and the fossa canina forms a moderate depression. The body of the zygomatic bone is largely disposed in a lateral plane. The subspinal point is 25 millimeters ahead of the zygomaxillar chord, and the nasion is 18 millimeters ahead of the bimolar chord, which gives the lateral profile indices of 25 and 16, or, using the angles at the median points, of 128 and 143 respectively. Roughly similar values characterize the other Late Paleolithic skulls: Předmost II, 115 and 143; Combe-Capelle, 121 and 143; and Cro-Magnon I, 132 and 146.

The nose bridge is of medium width and small in height. The symotic index is 40.4 (compared with 44.4 for Combe-Capelle and 46.6 for Cro-Magnon). Thus, as distinct from the brainpan, the facial skeleton of most skulls of the series under study conserves features of an elevated vertical relief and a lowered horizontal relief, a combination comparatively rarely encountered in modern race variants.

The nasal bones are of an elongated diamond shape; the nasal index is equal to 49; the nasal orifice has a typical pear shape. The orbits are slightly inclined and small in height; the index from dacrion is 76.

The Mandible

The amount of material lending itself to comparative quantitative characterization is relatively small; we shall confine ourselves to brief commentary on the measurements given in Table 2. The projected length of the denture from the tangent to the third molars to the infradentale amounts to 51 percent of the length from the angles, which in turn is equal to 76 percent of the length from the condyles. The front premolar length is 17 millimeters, or 38 percent of the total denture length. The body thickness in the region of the foramen mentale is 11 millimeters, the height of the orifice above the base is 15 millimeters, the height of the body is 36 millimeters, and the height of the alveolar arch proper is 21 millimeters, or 60 percent. The dimensions of the branch are large; the shape is medium. All these figures testify to a considerable massiveness of the mandible. The eminentia mentalis is well defined; the angle of pro-

tuberance is 66°. The inner and outer surfaces are relatively unstriated; the oblique line terminates at the level of the second molar. The spina mentale is a double one and has a shape typical of modern races.

THE CRANIOLOGICAL VARIANTS OF LATE PALEOLITHIC SKULLS COMPARED WITH THE SUNGHIR SKULL

The burials of the settlement of Kostenki (on the upper reaches of the Don) yielded four skulls. One of them, Kostenki XIV, is the most ancient and visibly differs from the others by its small brainpan and jaws, low nose bridge, sharply elevated nasal bones, prognathism, and broad nose. This skull is referred to as "Negroid," although the terms "Papuan-like" or "Vedda-like" would be more appropriate. This does not mean, of course, that its origin is traceable to the modern habitats of the mentioned types. The Kostenki II skull, which was in a poor state when found, upon restoration gave the lowest face height, 64 millimeters, which does not seem credible. Two other skulls are children's. For skulls XV and XVIII, the estimated dimensions which the two individuals were to reach upon termination of growth proved different: one was found to be high-faced, while the other was low-faced. The Sunghir skull lies within the range of variation of the Kostenki skulls (except for skull XIV, naturally), which suggests that the forest–steppe belt between the rivers Klyazma and Donets was inhabited by mammoth hunters who belonged to a single, though variable, physical type.

In central and western Europe, several scores of Upper Paleolithic skeletons or separate bones have been found, of which there are about twenty skulls or skull fragments lending themselves to comparative characterization (Gokhman 1966; Vlček 1967; Jelinek 1954). Vlček and Jelinek single out two Upper Paleolithic craniological complexes, "Cro-Magnon" and "Brno-Předmost." A third complex, "Solutré," must also be recognized. The Cro-Magnon type is most fully represented by the skulls from Cro-Magnon, Barma-Grande and Children's Grotto, while the other two types are represented by three male skulls each, taken from the burials in the respective localities. None of the three groups is homogeneous enough. Thus, in the first group, the bizygomatic diameter of the skull from Children's Grotto (156 millimeters) is at the upper limit of the range of variation of all Upper Paleolithic skulls; the Cro-Magnon I skull (140 millimeters) is only 0.15 short of the lower variation limit. The Barma-Grande II skull has a remarkably small porion–bregma diameter. There are marked differences between the two skulls in terms of scopic indices: Cro-Magnon I is more ovoid and its nasal bones are sharply elevated, whereas the Children's Grotto skull is a wide ellipsoid, with the nasal bones forming a slight elevation. The intragroup differences in the

Cro-Magnon and Předmost groups are somewhat greater than the intergroup ones; the Solutré group differs considerably in the structure of the braincase. The mean difference by five neurocranium and four splachnocranium dimensions, determined according to the Penrose C^2_R coefficient, is as follows:

Skulls	Braincase	Facial skeleton
Cro-Magnon I, Children's Grotto	0.15	1.56
Cro-Magnon I, Předmost III	0.95	1.04
Cro-Magnon I, Solutré	3.17	0.29

Yet skull IV from the Solutré group differs from the Cro-Magnon I by only 0.58 in terms of the brain-section size.

The difference of the mean group values is statistically unreliable, given the small size of the groups and the limited number of dimensions for which comparative data are available. Still, the values are of some interest; they are given in Table 3.

Table 3. Comparison of Cro-Magnon, Brno, and Solutré skulls

Dimension (millimeters)	Cro-Magnon	Brno	Solutré
Male skulls: n	3–4	3–4	2–3
1. Longitudinal diameter	201	197	181
8. Lateral diameter	149	140	149
9. Least frontal	105	99	98
20. Height from porion	114	116	123
43. Jaw height	70	73	70
44. Maximum zygomatic width	146	140	144
54:55. Nasal index	49.5	45	54

The differences of the means of the female skulls follow a similar pattern. Two female skulls from Solutré are mesocranial, while two skulls from Předmost and the Brno III skull are hypsicranial, high-faced and narrow-nosed. The Brno III skull with a preserved facial section largely complements the group characteristic, the group being appropriately referred to as "Brno," though the facial dimensions for the male skulls have not been determined. The Dolni Vestonitse II and III skulls are close to the Brno group.

On the whole, the three groups differ in the general formative trend, though this trend is moderately pronounced.

In the Cro-Magnon group, the first variant is a shift from the median type toward a longer, wider, and lower form of the brainpan, combined with a medium width and a low height of the maxilla.

In the Brno-Předmost group, there is a shift toward relative hypsicrania at a medium skull width and at a greater-than-medium length, combined with a high (or rather high), medium-wide, and narrow nose.

In the Solutré group, the skulls are of small length and great width and height, and the nose is wide, with a high nasal index.

The three morphological trends represented by the European Upper Paleolithic skulls are less manifest than in many subsequent series, among which one encounters clear hypsidolichocranial, euryplaticranial, and other variants. The three noted types belong to the early stages of differentiation. One of the earliest Upper Paleolithic skulls, Mladeč I (Lautsch), belonging to the early Wurm period, is distinguished by virtue of certain primitive features in conjunction with an atypical combination of platicrania and clear signs of a narrow face. The original form of the Mladeč I variant had definitely existed in the preceding epoch and differed from the synchronous paleoanthropes in the facial skeleton structure. The finds of the subsequent periods have no parallels with the Mladeč I skull.

Another comparatively ancient burial (W2/3) was discovered in Switavka, not far from Brno. A photograph of the not-quite-preserved facial skeleton shows a low but not wide maxilla, high eye sockets, and a high nasal index. The peculiar features of the Switavka skull have no analogues in later periods either.

One of the more morphologically determined craniological variants of the Upper (comparatively late) Paleolithic is the Chancelade skull, steno-hypsicranial, high- and medium wide-faced, and narrow-nosed. This skull differs from the Brno type by the metric index (by a C_R^2 coefficient of more than 1.0), as well as by many scopic features such as superciliary structure, shape of the nasal aperture, inclination of the front portion of the alveolar process, etc.

Neither can two other narrow-faced variants, the Combe-Capelle and the Pavlovo skulls, be classified together with the Brno group under a single morphological category. The two skulls, despite their similarity of braincase dimensions, are not homogeneous in terms of facial skeleton structure. The Combe-Capelle skull has smoother superciliary arches, the cheekbone is largest in the lateral surface, the alveolar process is straighter; the zygomatic bone has a large segment lying in a lateral plane; the protaberantia mentalis is hardly manifest; and the mandible branch is wider and more solid. Of the ten measurements used, eight give a deviation amounting to one or two points (on a three-point scale); of the ten dimensions, six are beyond the Brno group's range of variation. There are too few elements of the facial skeleton preserved in the Pavlovo skull to permit a quantitative comparison with other skulls, but a comparison of the contours reveals its significant differences from the Předmost III.

The peculiar skull from Oberkassel is close to that from the Children's Grotto in many respects, not, however, including the structure of the mandible, particularly in its markedly jutting angles.

As for the comparative characteristics of the Sunghir skull, its devia-

tions, and those of the other best-studied skulls, from the minimal range of variations of Late Paleolithic skulls are shown in Figure 1. The deviations are expressed as decimal fractions of the maximum difference, so that a deviation of 0.4 to 0.5 signifies a marked difference within the group under study. In order to evaluate the similarity by the total mean measurement indices, see Table 4. Mean square deviations (C^2_R coefficient according to Penrose) are given separately for the brainpan size and for the facial skeleton.

The Sunghir and Předmost skulls proved to be the closest to each other, particularly with regard to facial dimensions. This, however, does not rule out considerable differences in structure visible in photographs.

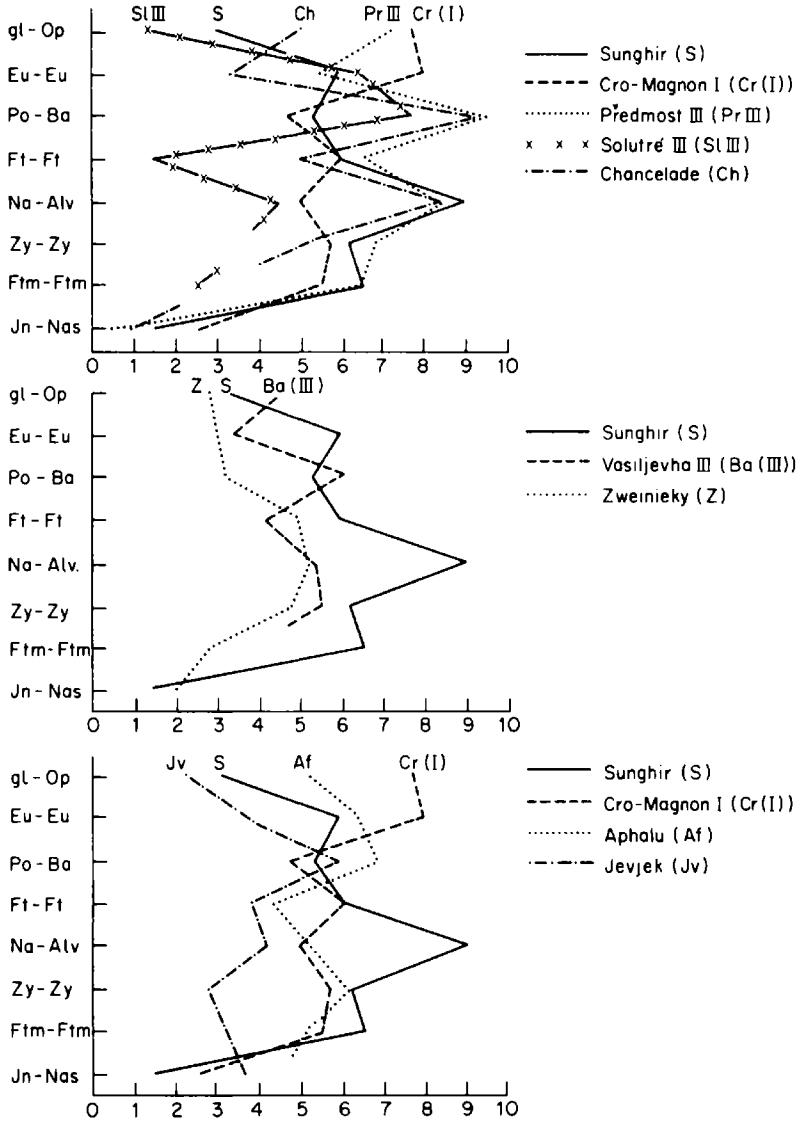

Figure 1. Distances from minimal values for European Late Paleolithic skull series (the distances of the measurements are given in decimal parts of the difference between maximal and minimal values)

Table 4. Comparison of Sunghir skull with other Late Paleolithic skulls

Skull compared with Sunghir	$C_{\frac{3}{4}}$
Předmost III	
brainpan	1.42
facial skeleton	0.16
Combe-Capelle	
brainpan	2.22
facial skeleton	0.51
Pavlovo	
brainpan	1.65
facial skeleton	–
Solutré	
brainpan	2.17
facial skeleton	1.14
Cro-Magnon	
brainpan	1.60
facial skeleton	1.18

Regarding the comparison by scopic indices, here is an example of evaluation of similar variants within one class on a three-point scale. Of the ten indices, the Sunghir skull had five indices in common with the Předmost III.

Thus, the similarity of the metric and scopic indices for Late Paleolithic European skulls follows no system and forms no different groups, except that there is a predominance of one of three combinations of indices noted for a limited number of specimens — some ten out of forty male skulls — about which sufficiently detailed information is available.

Craniological polymorphism is a significant peculiar feature of the Late Stone Age European population (Bunak 1959). Mammoth hunters lived and moved in small groups formed around one hearth (four or five men in most cases) (Pidoplichko 1970) that from time to time united for a joint hunt or feast. Individual groups followed herds of hoofed animals over considerable distances. Prolonged contact of different groups, a necessary prerequisite for the consolidation of a type at a low population increase, was rare. The Late Paleolithic skeletons, with very few exceptions, have been found in isolated burials and represent different variants of the early phases of skull shape differentiation, which had not at the time reached a complete form refined by selection. Some variants have a paneukumenic spread: the Oberkassel skull matches the Keylor skull from Australia in sagittal contour, and the Combe-Capelle skull is close to the male skull from the Chou Kou Tien cave: the facial skeleton difference between the compared forms is no greater than that within the European Cro-Magnon group. At the stage of the Late Paleolithic in Europe, no intraspecies taxons had yet emerged. However, this does not rule out the possibility of an uneven spread of some complexes: for example, a possible link of the Cro-Magnon complex with the western

Mediterranean (Mesolithic burial ground in Afalu), or of the Brno type with the eastern Mediterranean (the Erk-El Amar in the Palestinian Mesolithic).

Such are some of the results of our comparative craniological investigation in which we dispensed with *a priori* race-typological schemes and in which we attempted to throw some light on the process of formation of ancient variants.

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The Settlement of Non-Saharan Algeria from the Epipaleolithic to Modern Times

M.-C. CHAMLA

The numerous human skeletal remains found in Epipaleolithic, Neolithic, and protohistoric strata in Algeria have for more than a century been neglected in extensive synthetic studies attempting to retrace the settlement process of this country. Moreover, anthropology of the present population there has been badly understood for some time and has depended upon ancient and incomplete data. The research in this area is now sufficiently advanced to permit a general preliminary view of the origins and stages of settlement for the area of Algeria north of the Sahara, shown schematically in Figure 1.

THE EPIPALEOLITHIC

In the Epipaleolithic period, North Africa was inhabited by a population with robust characteristics, just as were certain regions of Europe and the Near East at the same time. There were two fundamentally different types of people then, one, having Cro-Magnoid morphology and called the "Mechta–Afalou" type, preponderant in Ibero-Maurusian strata, and the other, "proto-Mediterraneans," having Mediterranean affinities and revealing early traces in Capsian strata.

The oldest and most important Ibero-Maurusian burial grounds going back to the eighth through twelfth millennia are those of Taforalt in Morocco and Afalou-bou-Rhumel in eastern Algeria. These contained remains of individuals whose morphology is quite well known and typical, and whose most important aspects are the following: general hardiness, extreme thickness of skulls, above-average dimensions of the cranium and the rest of the skeleton, tendency toward mesocephalism, wide and

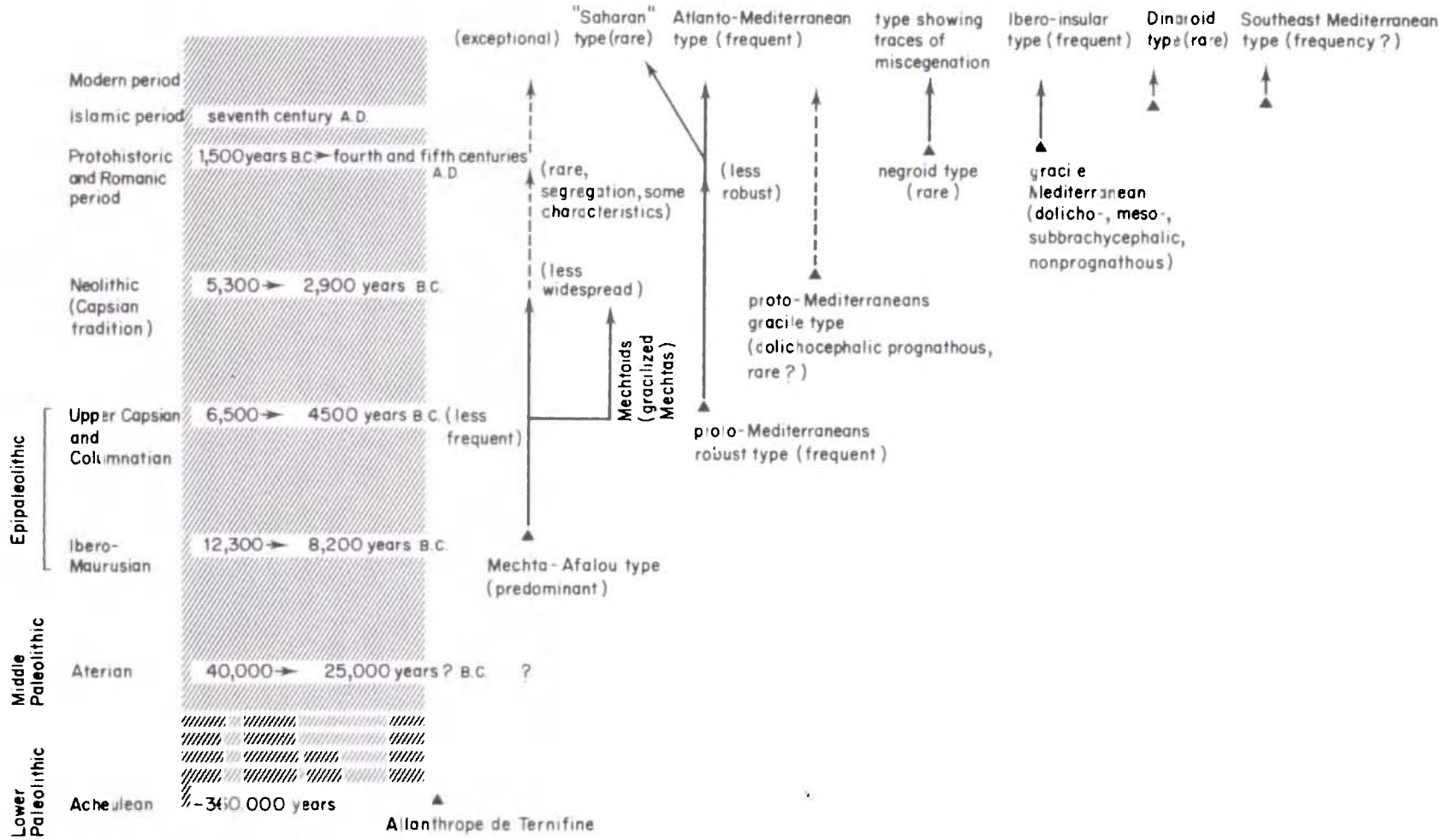

Figure 1. Evolution of the settlement of northern Algeria

short facial area with prominent suborbital arcades meeting in a median rim, low and rectangular orbits, large mandible having quite a slanted body and lateral projection of the gonions, prominent chin, and rather large denture with numerous pathological lesions. The stature of these people is rather great, their shoulders wide, their skeletons very robust. Also, they practiced mutilation of the teeth, surgically removing the upper incisors. Comparison of males and females from these strata demonstrates the presence of a quite accentuated sexual dimorphism, particularly common in prehistoric populations, notably among the Mesolithic tribes.

This description gives a stereotyped image of the Ibero-Maurusian people of North Africa. But actually, the comparison of the people from the Ibero-Maurusian strata shows that the unity of the Mechta–Afalou type was far from perfect. Certain differences noted among these peoples indicate that there was probably independent evolution of small groups of Ibero-Maurusians from an original common type. Some of them, notably those found in the strata more recent than that of Afalou, show signs of becoming more gracile and more brachycephalic. The people from the burial ground of Columnata in western Algeria — whose majority can be dated from about 6,000 to 5,000 years before the modern age — are a typical example of this. These people of the "Mechtoid type" show in fact less hardiness in general, less significant dimensions of the cranium and long bones, a more marked tendency toward meso-brachycephalism, less-developed bony ridges, and a less-voluminous denture, all characteristics which denote gracilization with respect to the older Ibero-Maurusian remains. The destruction of the teeth was in this population less premature and less intense, with caries significantly more apparent, indicating probable dietary modifications and less resistance to cariogenic factors than their predecessors. Finally we can note among these people the extension of the dental avulsion to the two maxillaries and eight incisors. Such a fact might indicate that there were contacts between these people and their contemporaries found in the Capsian strata of Algeria, where such a practice was fairly common.

This phenomenon of gracilization of the skeleton apparent among these people fits into a general process of evolution which has been noted in populations who are quite distant geographically. Independent of the racial factor, the phenomenon does not correspond to a general process occurring at a single point in time, however, since it has been attested to in populations of varying historical periods. It seems to be related to an evolutionary tendency found in human groups who occupy a given geographic area for a fairly long period of time, who are sedentary, and among whom the selective processes which tend to eliminate the least-resistant individuals could have played a less predominant role.

The physical characteristics of the Mechta–Afalou have often been compared with those of European Cro-Magnoids, but their origin has not yet really been clarified. We might note simply that other people of the same type, contemporaries of the Taforalts and of the Afalou-bou-Rhumels, have been discovered in Lower Nubia in the Djebel Sahaba, along with indications that they had a basically microlithic industry related to that of the Ibero-Maurusians of North Africa. Although the sum of their traits shows a certain blood relationship to the North African Mechta–Afalou type, some definite differences are nevertheless discernible, notably a very marked orientation toward negroid characteristics such as alveolar prognathism and platyrrhinism and also — a quite remarkable feature — absence of any dental avulsion.

The second fundamental element of the Epipaleolithic people of Algeria is represented by the proto-Mediterraneans found in the strata of the upper Capsian. Let us note first that these strata, mostly centralized in the eastern part of Algeria, exhibited not only proto-Mediterranean-type people but also some with Mechtoid morphology. This fact demonstrates that in both middle and late Epipaleolithic periods, the population of certain regions was undoubtedly composite.

The morphology of the North African proto-Mediterranean element is quite easily distinguished from that of the Mechta–Afalou types. It is characterized by a cranium which is generally elongated, a higher facial area, a narrower nose, and especially orbits which are less low, suborbital arcades which are less developed, a mandible whose gonion region is not turned out at all, the horizontal branch being higher and the vertical one more straightened, a less-pronounced stature, and a skeleton whose reliefs are generally less prominent. However, these proto-Mediterraneans were far from gracile and their skeletons did exhibit a certain hardiness. Besides, just as was the case for the Mechta–Afalou types, we can note, by studying the individual types, that there was a certain variety among them. At least two subtypes can be isolated, whose differences have to do mostly with the height of the facial area and the height of the cranium, i.e. one dolicho- or mesocephalic variety with an average face height and low skull dome, exemplified by the man found in the Aïn Dokkara snailery; and a second variety which is also dolicho- or mesocephalic with a very long face and a raised skull dome, exemplified by the man found in the Aïun Beriche stratum. It is interesting to note that these two variants are both represented in the present Mediterranean race and that they already exhibited differences in the Capsian strata.

Accentuated sexual dimorphism is apparent as well, just as was the case with the Mechta–Afalou people; it appears to be a trait typical of these proto-Mediterraneans. The females found up to now in the Capsian strata exhibit all the characteristics of gracility, which contrast with the relative

hardiness of the males. The females also have a wider skull and are clearly mesocranial while the men are dolichocranial. Prognathism appears occasionally in some individuals, not accompanied by platyrrhinism. This characteristic, which is apparent in present-day Mediterranean peoples, seems to correspond to a specific trait of certain Mediterraneans and to be independent of any negroid influence. We can note as well that in the Capsian proto-Mediterraneans there was an extreme rarity of dental caries, as opposed to the situation with the people of Mechta–Afalou, and a practice — not generalized, however — of avulsion of four to eight incisors on both jaws.

The Capsian strata contained not only proto-Mediterranean types, but also types which were clearly Mechtoid (Mechta-el-Arbi). The number of individuals exhumed from these strata who were in a good-enough state of preservation that a satisfactory evaluation of their racial heritage could be made has now reached twenty-five. Within this group, we might say that about 40 percent are typical of the Mechta–Afalou race and that 60 percent belong to the proto-Mediterranean class. But we must note, however, that except in the Medjez II stratum (eastern Algeria), where the two types coexisted, there seems to have been a rather clear separation between the two elements, who are generally not found together in the Capsian strata discovered to date.

Among the sixteen proto-Mediterraneans in question, five show the characteristics of a long face and a high skull dome and four show those of the variant with a shorter facial area, while seven are less clearly classifiable. Let us add here a fact which may need to be emphasized: the absence of brachycephalism in these people from the Capsian strata. But brachycephalism was not an unknown characteristic in Algeria in the Epipaleolithic period, for a small number of brachycephalic individuals have been found at Afalou and at Columnata. This brachycephalism moreover seems to correspond to a whole process of brachycephalization, quite localized in this area and affecting the mesocranial elements of the population, which was not a result of borrowing of foreign elements morphologically different from the rest of the population.

The arrival of the Capsian proto-Mediterraneans, whose traces are not to be found in the most ancient Ibero-Maurusian strata (where only the Mechta–Afalou type is represented), dates back at least to the seventh millennium. This date corresponds approximately to those established for the European Mesolithic on the one hand and the Near Eastern Neolithic on the other.

The descriptions which have been made of southern European Mesolithic people — notably of the Mugem Portuguese and of the people of the Pyrenees area — differ in many ways from those of the North African proto-Mediterraneans. These people were characterized particularly by skeletons which were not very robust, exhibiting small stature,

low orbits, and average cranial capacity — all of which are traits which are not found in the people of the upper Capsian of Algeria. These latter on the other hand seem to be more comparable to the descriptions of the robust proto-Mediterraneans who were widely spread about in Neolithic times in some areas of the Near East. These proto-Mediterraneans, it might be noted, were already prevalent in an earlier era of history in the Natoufian area of Palestine. There seems to be no doubt that the origin of the North African proto-Mediterraneans should be researched in the eastern part of the Mediterranean basin. A certain number of common characteristics is in fact apparent in skeletons from North Africa and the Near East: tendency toward large stature and toward a certain general hardiness in the males, increased cranial capacity, dolicho- or slight mesocephalism associated with an elongated face or one of medium height, certain occasional prognathism, great development of the mandible (whose vertical branch exhibits a particular morphology). Two other facts should not be neglected here: the similarity between the frequencies of caries lesions, whose number is particularly low among both North Africans and Near Easterners; and the extension to the two maxillaries of the avulsion of the incisors, less widespread though this may be in the Near East than in Algeria. This practice was unknown among European Mesolithic peoples.

THE NEOLITHIC

This robust Mediterranean type does not predominate for a long time in Algeria. The type shows up again in the Neolithic, parallel with elements of the Mechta–Afalou type. These latter, particularly robust, were especially prevalent in the western part of the country in Orania, and they cooccurred with peoples having other Mediterranean affinities but also being more gracile, such as are found in Tunisia (Kef-el-Agab and de Redeyef grottoes) and in the southeastern part of Algeria in Aurès (Khenchela and Batna grottes). The latter element is characterized by a rather slight stature, dolichocephalism, facial area with variable height but unusual length, and a rather remarkable characteristic, prognathism, which is sometimes quite pronounced and without which the set of morphological traits would not exhibit any negroid characteristics at all.

Nevertheless, we still have far too few samples of these people to give us a satisfactory overview of the settlement of Algeria in the Neolithic. This paucity of data is probably due to the fact that remains found in Neolithic strata are relatively rare.

THE PROTOHISTORIC AND ROMANIC

In the protohistoric era (VIth c. B.C.–IInd c. A.C.) the Mediterranean type becomes the preponderant one in the megalithic sepulchres of Algeria. The human remains found in the burial grounds of North Africa have been recently studied (Chamla 1975b; 1976). Robust types were found together with more gracile individuals, both belonging to the Mediterranean type. The problem apparently lies in determining whether these latter are the descendants of the proto-Mediterranean Capsian people, who underwent morphological modifications in the direction of gracilization analogous to that of the Mechtoids, or whether they correspond instead to new arrivals belonging to the gracile Mediterranean type.

If the Epipaleolithic proto-Mediterranean peoples are compared to those of the protohistoric period, it will be clear that the relative cranio–facial proportions in the two groups are not fundamentally different. We find among the protohistoric three main elements: (1) dolicho–hyper-dolichocranic skulls with a long face of variable robustness, a narrow nose, and a tendency to prognathism (22 percent); (2) dolichocranic skulls with a middle or short face (23 percent), less frequently robust than the first group and (3) mesocranic skulls with a middle or shorter face (20 percent), orthognathic. These three elements may be linked to the Mediterranean type. A small number of mesocranic skulls with long faces (7 percent) have been considered as an Atlanto–Mediterranean type. The brachycephalic element is rare (6 percent). Individuals of Mechta–Afalou type (7 percent) as well as individuals of Negroid type (12 percent) have been isolated in the series. Comparisons with other Mediterranean populations of the Bronze Age shows that the anthropological situation of Algerian protohistorics seems to correspond to the geographical position: their affinities are directed toward western Mediterranean as well as toward Canarian and old Egyptians.

Although the sepulchres of the protohistoric period are extremely poorly dated and some of them are relatively recent (from the first centuries of our own era), it seems preferable to consider separately the populations of the protohistoric and Romanic periods. The latter is not very well known, but the study made by Boulinier and Chabeuf (1971) of forty skulls from the Romanic and Paleo-Christian epoch in various regions of Algeria shows that the morphology of the population of this period is not significantly different from that of the Megalithic sepulchres. This conclusion is not surprising, since the latter appear to be more recent than was earlier thought. This does not mean that the bodies buried in the Megalithic sepulchres and those of the Roman burial grounds were actually representative of the population of this period. But it can be ascertained that, since the protohistoric period, the population has not

been fundamentally different from the present population, and it was then already as anthropologically diversified as it is today.

THE MODERN

The diversification of the present Algerian population does not correspond, as was thought for some time, to precise geographic boundaries, nor does it correspond to the ethnolinguistic and historical differentiation which distinguishes the mountain-dwelling Berbers from the plains-dwelling Arabs. The two types, Arab and Berber, are conventionally described by ancient authors as follows: the one is quite tall, dolichocephalic, with an oval face and acquiline nose; the second is shorter, mesocephalic, with a square face and a straight or concave nose. They do remain somewhat separate from each other, but they have mixed as well, and have adjoined other types whose morphology exhibits more varied characteristics.

The study which we have made (Chamla 1974) of the morphological and hematological characteristics of Algerians native to plains and mountain areas of the northern zone of Algeria shows that there has developed such a melting-pot situation that the gross anthropological distances between the regional groups studied now appear almost indistinct. This is the conclusion reached by Demoulin (1972) as well, following a study of present-day Algerian skulls from various regions of Algeria. However, a more extensive typological study has revealed the existence of varied elements among the present-day population.

Basically, there are three main types to be found in all the regional series, and their proportions, in general, do not vary to any great extent. The Mediterranean element is always the major one, making up about three-quarters of the population, and it appears to have three recognizable variants: (1) an Ibero-insular type whose characteristics essentially are a certain gracility, small to medium stature, and dolichocephalism, accompanied by an elongated or average-height face; (2) an Atlanto-Mediterranean type, just as well represented as type 1, whose characteristics include more hardiness, great stature, and dolicho- or mesocephalism, with a long to very long face; (3) finally, a type called "Saharan," rather infrequent, and with the characteristics of increased stature, dolichocephalism, and a face which is long to very long.

A second element which is fundamental but not very widespread has been classed as Alpine by certain authors. This name was given them because of their brachycephalism, short faces, and small stature. They constitute about one-tenth of the population, but it does not seem that they can be confused with the European Alpine type, if only because of the marked attenuation of the brachycephalism, the lateral development

of the jaws, and the frequently square shape of the face, all traits which do not characterize the Alpine type. The origin of this brachycephalic type seems to date from the protohistoric period (this type also comprises about 10 percent of the remains found in the Megalithic sepulchres), and the latter might very well represent a Mediterranean element having undergone a process of brachycephalization, a phenomenon which has been noted in numerous populations.

A third element with Armenoid ties characterizes less than ten percent of the subjects; the group is distinguished by medium to elevated stature, more or less accentuated brachycephalism, and an elongated face.

Beside these classes, some traces of the ancient Mechta–Afalou type can be found in a few meso- or dolichocephalic individuals with lowered faces, prominent jawbones, and high stature.

Signs of miscegenation with a negroid element (tawny complexion, larger nose, thicker lips, more or less pronounced prognathism, hair curled into crimps) are rare and appear in a rather dissociated manner, which might indicate a borrowing from the black element in ancient rather than in modern times. But we must not exclude here the hypothesis that some of these traits, notably the curly hair frequent among Algerians, as well as a certain alveolar prognathism, might correspond more readily to adaptive characteristics.

The presence of a Nordic element often pointed out by ancient writers, who believed that they perceived some trace of Vandal influence, does not appear to be obvious. Such an influence, according to these authors, was evident in light skin pigmentation and pale eyes as well as blonde hair. Although the color of the skin is indeed quite light among the majority of these people (especially the montagnards), dark hair is more predominant. Only an infinitesimal proportion of these subjects have light brown or dark blonde hair, though it is a bit less rare in the mountain areas than in the plains. Moreover, there is only exceptionally a connection between the feature of hair color and that of light-colored eyes. However, among children, especially in Grande Kabylie, blonde hair is quite frequent. Such coloring is apparent in most western Mediterranean cultures as well, but the characteristic generally disappears during adolescence. Dark colors are also predominant in the eyes, but green or light chestnut-colored eyes can frequently be found in the mountain areas (Kabylie and especially Aurès) and in the high plains of the east. This relative frequency of "mixed" colored eyes is not peculiar to Algerians but is apparent in other countries of North Africa as well, especially in Morocco. In fact, this frequency is also similar to that observable among some populations of the western Mediterranean area (southern Italy, Sicily, Corsica, Sardinia, Spain), where the number of people exhibiting this feature is quite a bit higher than it is in the eastern part of the Mediterranean basin. The frequency of pale-colored eyes (blue and

gray), varies from two to fifteen percent according to the region concerned.

Several differences have been noted between the mountain groups and the plains-dwellers: tendency of the former toward smaller stature, elongation of the trunk area, and greater width of shoulders, greater frequency of rectangular trunks, and more developed thorax — all of which are probably traits of an adaptive nature.

As for the head, the principal morphological characteristic peculiar to the Algerians is the diversity in the cephalo-facial relationship, notably the moderate-to-extreme disharmony in nearly half the Algerian population. This disharmony is usually manifested by the cooccurrence in an individual of a mesocephalic skull and a long-to-very-long face. A second peculiarity is the frequent lateral development of the jaws, which gives the face a square shape: 30 to 50 percent of the individuals examined have this characteristic, which seems to be more frequent in Grande Kabylie and in western Algeria than in other areas. The nose is quite narrow and its profile straight or convex, with the first type being more frequent in the mountain areas and the second more apparent in the plains. The lips are of medium thickness, the form of the hair is variable (from wavy to frizzy, the latter being the more frequent).

The study of fingerprints and of the various designs of the crown reveals great homogeneity in regional distribution. Moreover, the frequencies of the ABO blood types and of the Rhesus system are distributed in a similar manner in northern Algeria except in the Aurès, but there is not yet enough data on the latter area to confirm this. The Algerians are characterized by a low frequency of occurrence of blood group A and a higher frequency of group O, along with marked rarity of subjects having an Rh-negative factor. The frequencies of the Rhesus-negative individuals are lower than those found in other Mediterranean populations of Europe and the Near East, but are more similar to the very low frequencies observed among the melanoderm populations of Africa. This rarity of Rh-negative subjects among the Algerians cannot, moreover, be explained by a melanoderm influence, miscegenation with black elements of the population having been only occasional in the Tell and littoral populations, especially in Kabylie where the rarity of Rh-negative subjects is most marked. Such a difference with respect to the other Mediterranean populations must probably be attributed to selective processes which have not yet been clarified.

As regards the hemoglobin types, we find a rather high percentage of abnormal hemoglobins in Algeria, abnormalities which are responsible for various sorts of anemia and which are hereditary. Thalassemia, for example, is a form of anemia which appears to be quite widespread, and its percentage of occurrence among Kabylie subjects can go as high as 17 percent.

The anthropological position of present-day Algerians in relation to other Arabo-Berber populations of northern Africa, including the Sahara, indicates that there are definite ties between the Libyans and the Algerians. The latter are also associated with the Moroccans but show less similarity to the Tunisians and Egyptians. A second fact to be emphasized is the marked distance between the Algerians of the northern region — and, generally, all the sedentary groups of North Africa — and the nomadic inhabitants of the Sahara. These divergencies between the inhabitants of the Tell zone and those of the desert demonstrate that the Sahara has played the role of anthropological barrier, isolating the populations inhabiting it from one another, a factor favorable to the development of specific biological characteristics. Indeed, there is obvious diversity among the nomadic groups inhabiting the Sahara.

Analysis of the anthropological position of the Algerians in relation to the other populations of the Mediterranean basin shows that there are connections between them and certain populations of the western Mediterranean area, such as Corsicans, Sardinians, Spanish, and southern Italians. On the other hand, however, the anthropological distance between the Algerians and the central Italians, the Yugoslavs, and the sedentary populations of the Near East, such as Jordanians, Lebanese, and Syrians, appears to be rather great. Among these populations, the Armenoid type (which is quite different from the Mediterranean type) is in fact well represented, although it is not very widespread in Algeria.

In conclusion, the origins of the present-day population of Algeria seem to date from a period overlapping both the Epipaleolithic and the pre-Islamic epochs. There remains almost no trace at all of the ancient Mechta–Afalou type. This group seems to have disappeared after the Neolithic either by extinction or by melting into the proto-Mediterranean population which arrived in the Capsian period. The later conquests which the country has undergone do not seem to have modified essentially the original characteristics of the population. To what extent have the Arab conquest and later Turkish domination left traces upon the anthropological structure of the Algerians? It is difficult to answer this since we have no osteological documents dating from these periods.

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The Genesis and Evolution of the Neolithic Population of the Eastern Baltic Lands

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The Neolithic age in the eastern Baltic lands covers the period between the fourth and the middle of the second millennia B.C. This period saw the penetration into this territory of basic racial components which subsequently played a major role in the formation of the anthropological composition of today's eastern Baltic population.

Excavations of the Stone Age burial site of Zveinieki in the north of Latvia in 1964–1971 (headed by Zagorskis) yielded 101 crania[1] which for the first time represented the Mesolithic and all the periods of the Neolithic age. This material is complemented by Late Neolithic crania from the burial grounds of Abora (Lose 1968) in the northeast, and crania from Kreichi (Denisova 1960) and Yurkov (Vankina and Cimermane 1969) in the east of Latvia. Discovered in the territory of Estonia are two crania of the advanced Neolithic period (Valma) and ten crania of the late Neolithic period (Tamula [Mark 1956a], Kyliala, Vyiziku [Fürst 1914; Weinberg 1904], Sope, Ardu [Aul 1933], Kunila, and Karlov [Mark 1956b]). Thus far, Lithuania has only yielded one Neolithic cranium from Turloishkes (Mark 1956a).

The craniological materials mentioned above represent tribes of the Narva culture of the early Neolithic period, the advanced and late Neolithic population of the typical Pitted-combed Ware culture, and tribes of the Cord-pottery Ware and Battle-axe culture, as shown in Table 1.

The population of the early Neolithic period in the eastern Baltic lands is represented by twelve male crania from the burial site of Zveinieki. Their anthropological type is marked by a great mass, exceptionally large longitudinal and medium transverse diameters of the cranium, hyperdolichocephaly, a great basion-bregma height, a broad, relatively high

[1] Only the number of crania of adult individuals is mentioned here and elsewhere in the present report.

Table 1. Data obtained from crania found in Zveinieki, burial site of Neolithic cultures

Features		Early Neolithic Narva culture (Zveinieki)		Late Neolithic Battle-axe culture		Advanced and late Neolithic Pitted-combed Ware culture (Zveinieki)			
		Male crania		Male crania		Male crania		Female crania	
		n	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$
1.	Longitudinal diameter	9	194.1	5	195.4	40	187.6	11	178.9
8.	Transverse diameter	9	138.0	5	137.2	43	141.8	11	139.8
17.	Height diameter	9	145.5	3	140.7	37	139.8	6	134.2
9.	Minimum forehead width	10	98.3	4	97.5	41	99.5	11	96.6
45.	Bizygomatic diameter	8	138.9	2	136.5	31	139.8	7	133.1
48.	Upper height of the face	8	72.3	5	74.6	32	69.5	10	64.2
54.	Nose width	8	25.1	6	26.8	32	25.3	6	23.2
52.	Orbital height	7	34.1	5	32.6	38	32.5	10	32.6
77.	Nasomalar angle	5	134.9	3	133.5	32	142.1	8	145.8
–	Zygomaxillary angle	7	123.2		–	22	129.5	6	131.5
DS:DC	Dacryal index	6	58.4	3	58.0	23	59.5	8	54.7
SS:SC	Symotic index	6	55.8	3	49.8	24	50.7	8	46.0
75(1)	Nasal bones angle	5	33.6	3	29.3	23	28.9	3	26.0
8:1	Cranial index	9	70.4	5	70.3	40	75.6	10	78.6
54:55	Nasal index	8	46.7	5	50.2	32	48.7	6	47.3
52:51	Orbital index	7	78.8	4	72.5	37	73.5	10	75.5
48:45	Upper facial index	8	52.1	2	54.7	26	50.3	6	48.4

face sharply profiled in the horizontal direction (the nasomalar angle being equal to 134.9° and the zygomaxillary angle, to 123.2°), and a protruding nose with a high bridge.

The affinity of the early Neolithic population of the Narva culture of the eastern Baltic lands with the great Europoid race is beyond doubt. Such features as the marked mass, the relatively broad face, and the great dimensions of the cranium make it possible to identify them with the northern Europoids whose southern border apparently corresponded to that of the Ertebölle, Combed-ware (Poland) and the Dnieper-Donetsk (the Ukraine) cultures.

In all probability, the northern Europoids in this area were not marked by great homogeneity and displayed a number of local types. The tribes of the Narva culture are characterized by pronounced dolichocephaly and a moderately broad face (139 millimeters). These peculiarities do not allow us to identify them with the Ertebölle tribes (Bröste 1956; Hjortsjö 1945) and with those of the Dnieper-Donetsk culture (Gokham 1966; Zinević 1967:28–92), both of which are marked by a very broad face, a hypertrophic mass, and moderate dolichocephaly.

The nearest analogues to the markedly dolichocephalic anthropological type of the Narva culture tribes represented by the finds from the burial site of Zveinieki are found among the tribes of the Sredne-Stogov culture in the Ukraine (the Aleksandriyski burial site; Surnina 1963) and the people of the Funnel Beaker culture in Poland (Dzierżykraj-Rogalski 1958). A similar anthropological type is observed among the Neolithic crania from the Ladoga canal (Debetz 1948).

During the Mesolithic age, the markedly dolichocranial tribes with moderately broad and long faces inhabited the eastern Baltic lands (Denisova 1972), north-central Europe – Bottendorf, Gross-Tinz, Pritzerber See (Vlček 1967; Reche 1928, 1933) — and the neighboring territories of eastern Europe — Vasilievska I and Vasilievska III (Konduktorova 1957; Gokhman 1966:21–95). There are reasons to believe that the hyperdolichocranial early Neolithic population of the eastern Baltic lands descends genetically from the related Europoid population of north-central Europe and the neighboring areas of eastern Europe of the Mesolithic age. The movements of the new markedly dolichocranial population from this territory to the eastern Baltic lands did not occur on only one occasion. It began in the Mesolithic age, when the eastern Baltic lands were being populated by man, and, apparently, continued through the early Neolithic age. The markedly dolichranial Europoid tribes inhabited the eastern Baltic lands, coming as far as Lakes Ladoga and Onega, where they are represented by craniological material from the Ladoga canal and some crania from the Oleneostrovsk burial site. In the early Neolithic age this territory must have been the northeastern borderline of the habitat of the hyperdolichocranial Europoid population.

The middle of the third millennium B.C. saw the appearance in the eastern Baltic lands of tribes of the typical Pitted-combed Ware culture. An idea of their anthropological type is given by the craniological material from the burial grounds of Zveinieki (sixty-three crania), Abora, Kreichi, Yurkov, Valma, and Tamul in Latvia and Estonia, and by the cranium discovered at Turloishkes in Lithuania. Thus far, the tribes of the typical Pitted-combed Ware culture in the eastern Baltic lands are represented by eighty crania of adult individuals.

The anthropological type of these tribes is marked by large lengthwise and transverse diameters of the cranium and very high basion-bregma and mesocrania. The face is broad, of medium length, Eurianian, and slightly profiled in the horizontal direction. The nasomalar angle of the male crania from the Zveinieki site equals 145.8° and the zygomaxillary 131.5°. The nose is marked by a moderately high bridge and a small angle of the nasal bones.

The same anthropological type is observed among the advanced and late Neolithic tribes in Estonia. The peculiar features of this type are distinctly traced in the Lithuanian cranium as well (Iakimov 1956; Vitov et al. 1959).

In general, the tribes of the typical Pitted-combed Ware culture are distinguished from those of the Narva culture by mesocrania, a lower and flattened face, and a less protruding nose. Hence, the formation of these tribes proceeded on an absolutely different basis. However, the craniological material from the Zveinieki site bears witness to direct contacts among the early and advanced Neolithic tribes of the eastern Baltic lands and their mutual assimilation.

The mesocranial type with a broad and flat face of medium length has no analogues in the synchronous palaeoanthropological material south and west of the eastern Baltic lands. Our interest has also been aroused by Neolithic craniological materials of the forest zone of eastern Europe. To begin with, we shall deal with the rich craniological material from the Oleoneostrovsk burial ground on Lake Onega (Iakimov 1960).

Those tribes are marked by mesocrania, a broad, flat face of medium length, and a slightly protruding nose. A comparison of this type with the craniological series from the Zveinieki site shows a great similarity between them. Some features are absolutely identical. There are only some minor differences in the texture of the face. The Oleneostrovsk samples display a flatter and longer face, less profiled horizontally. Judging from the intragroup correlation ratios, both craniological series, the Oleneostrovsk and the Zveinieki, are hybrid, with identical original components. It has already been indicated that the early Neolithic hyperdolichocranial population of the eastern Baltic lands was assimilated by migrant tribes of the typical Pitted-combed Ware culture. Thus, the anthropological type of the advanced and later Neolithic periods in the eastern Baltic was

formed as a result of an interaction of two components, the dolichocranial Europoid and the mesocranial, with a slightly profiled face. This is also the case with the craniological material from the Oleneostrovsk burial site, wherein similar components are distinguished on the basis of intra-group correlation ratios.

The first markedly dolichocranial component is no doubt of Europoid origin; this is not the case with the second type, which is well represented among the tribes of the advanced and late Neolithic periods in the eastern Baltic area and in the material from the Oleneostrovsk burial ground. Such characteristics of this type as a feeble profiling of the face on both levels and the slightly protruding nose testify to the presence of the Mongoloid component among the tribes of the Pitted-combed Ware culture in the eastern Baltic lands.

Judging from all the craniological material available, the hybrid mesocranial anthropological type with a flattened face lived during the Neolithic age east of the Baltic area, mainly in the forest zone of eastern Europe. A number of anthropological finds indicate the presence of a similar complex of features in the Neolithic population of that region (Akimova 1953). The eastern Baltic area during the advanced and late Neolithic periods used to be the western periphery of the hybrid mesocephalic anthropological type with a slight horizontal profiling of the face. At present, it is difficult to establish to what degree this type is spread through the eastern Baltic lands. All the burial grounds whose craniological material shows the hybrid mesocranial type are located in the east of Latvia and Estonia. The only analogous find at Turloishkes testifies to the penetration of this type into Lithuania as well. It seems, however, that here the distribution of this type is negligible.

The hybrid mesocephalic anthropological type of the eastern Baltic lands is related to the tribes of the typical Pitted-combed Ware. According to archaeologists, these tribes came in the middle of the third millennium B.C. to the eastern Baltic lands from the Lake Ladoga territory where they had originated (Gurina 1967). In the territory under survey, these tribes are identified with the ancient Finns.

The ratio of the hybrid mesocephalic anthropological type in the Neolithic population of Estonia and Latvia must have been quite substantial, as its traits were preserved in this territory, in a somewhat modified form, over a long period of time and are observed in all places inhabited in the past or at present by Finnish-speaking peoples.

At the turn of the second century B.C., new tribes penetrated into the eastern Baltic lands. These tribes are known in archaeological literature as the tribes of the Cord-pottery Ware and Battle-axe culture. An idea of their anthropological type is given by a small craniological series from Estonia (Fürst 1914; Aul 1933; Mark 1956a). This type is very massive and markedly dolichocranial, due to great longitudinal and medium

transverse diameters, with very high basion-bregma and a moderately broad, long face profiled in the horizontal direction. The Cord-pottery Ware anthropological type is sharply contrasted with the Pitted-combed Ware type that preceded it in the area by its elongated cranium and the narrow, long face strongly profiled in the horizontal direction. The affinity of the anthropological type of the Battle-axe culture of the eastern Baltic lands to the great Europoid race is not in the least in doubt. A similar anthropological type is found among the related tribes of the Zhutsev culture in the upper reaches of the Vistula (Perret 1943; Denisova 1971) and the Fatianovers in the territory between the Volga and the Oka (Denisova 1966, 1971).

In archaeological literature, the tribes of the Battle-axe culture in the eastern Baltic lands are identified with the first ancient Balts in this territory. A comparison of craniological materials of the Baltic tribes mentioned in the chronicles of Heinrich of Livonia (Heinrici Chronicon Livoniae 1955) with the anthropological type of the tribes of the Battle-axe culture makes it possible to regard the latter as pre-Balts, genetically related to the later Baltic-speaking population of this territory.

Fresh craniological materials obtained over the past years in Latvia give a general picture of the genesis of the markedly dolichocranial anthropological type of the Baltic tribes of the turn of the second century B.C.

There is every reason to regard the markedly dolichocranial massive Europoid type of the tribes of the Battle-axe culture in the eastern Baltic lands as a later offshoot of the similar hyperdolichocranial type of the early Neolithic tribes represented in the particular territory by the craniological material from the Zveinieki burial ground. The anthropological types of these tribes show great similarities in the dimensions and proportions of the cerebral part of the cranium. There are also some similarities in facial texture. The tribes of the Battle-axe culture of the latter period have narrower and longer faces. It must be remembered, however, that these tribes are separated by a lapse of almost 2,000 years. Hence, the lesser malar diameter (by 2.4 millimeters) of the tribes of the Battle-axe culture must be regarded as a result of the epochal variability. Such a supposition seems to be well grounded. With the hyperdolichocranial tribes of the Cord-pottery Ware culture of east Europe and the eastern Baltic lands early in the second millennium B.C., the width of the face did not exceed 135–136 millimeters, while the malar diameter of the Mesolithic and early Neolithic tribes with a markedly elongated cranium reached 140–141 millimeters.

The length of the face of the tribes of the Battle-axe culture measured in five individuals (74.6 millimeters) has to be regarded as a result of a random sampling in which the mean value is overestimated and is of a random nature. There are also indirect indications to this effect. The

tribes of the Fatianov and Zhutsev cultures which are, doubtless, closely related to the tribes of the Battle-axe culture, had still shorter faces.

All these considerations point to the probability of a genetic kinship between the tribes of the Battle-axe culture of the eastern Baltic lands and the markedly dolichocranial early Neolithic population of this area. This kinship, however, is not to be regarded as direct continuity. Judging from materials of the Mesolithic age, the area of distribution of the markedly dolichocranial anthropological type was initially north-central Europe and the neighboring territories of eastern Europe. It is precisely from this area that the hyperdolichocranial Europoid population moved to the eastern Baltic lands where traces of its habitation can already be observed in the Mesolithic age. It seems that in the periods that followed there were repeated migrations of hyperdolichocranial tribes from north-central Europe to the eastern Baltic lands. This is shown by craniological material of the early (Zveinieki site) and late Neolithic periods (the tribes of the Battle-axe culture).

Thus, in the Neolithic age, the population of the eastern Baltic lands was marked by two basic anthropological types. The first is the hyperdolichocranial Europoid type that originated in north-central Europe, and the second is the mesocranial hybrid type whose nearest analogues are found to the east of the area under survey.

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Villanovians and Etruscans in the Bologna Area: Anthropological Features and Problems

FIORENZO FACCHINI

The Villanovian civilization (ninth to sixth centuries B.C.), borrowing its name from a place not far from Bologna, and the Etruscan civilization (fifth to fourth centuries B.C.) flourished during the Iron Age in the area in which Bologna is presently located.

The numerous discoveries that have been made since the last century prove that the Bologna Villanovian culture is the local expression of a culture that spread throughout central as well as southern Italy; they also show the development of the Etruscan civilization over the Villanovian area in Tuscany and Latium (Etruria) and in the regions extending southward and, more importantly, northward as far as the eastern Po Valley.

As a matter of fact, some important centers of Transapennine Etruria are well known: Felsina, which developed from a nucleus of Villanovian culture; Marzabotto (also known as Misa), situated about twenty kilometers southwest of Bologna; and Spina, the Adriatic port that allowed eastern influences into the south-Etruscan area.

The centers of origin and the spread of the Villanovian culture into our territory are still subject to research and conjecture. It is generally accepted that influences penetrated from northern or Balkan regions either by land or by sea (from the south), or even from the distant Aegean areas. It has been proven, however, that connections and fusions with local nuclei (proto-Villanovian), as well as ethnic and cultural infiltrations from elsewhere, must have taken place.

The origins of the Etruscans are no less obscure. Their cultural features, as remarked by Pallottino (1971), show deep links with Italian protohistory, although eastern and Greek influences are unquestionable.

Undoubtedly, even the anthropological description of the types

belonging to the Villanovian and Etruscan populations is linked with cultural features. Although we no longer accept the identification of them both with well-defined racial types, the problem of ascertaining which populations inhabited our territory in a protohistorical era and what their connections were with the groups belonging to other regions remains unsolved. Above all, we wonder whether the ethnic Etruscan set represents a thoroughly new event, associated with populations from eastern countries or from northern Europe, or whether there was a certain anthropological as well as cultural continuity between the Etruscans and the Villanovians.

Presently, different scholars, above all archaeologists, are more and more inclined to accept the notion that the ethnic Etruscan formation may have been an essentially local occurrence. The most ancient phase of the Etruscan people has been identified in the cultural horizons of the Villanovian era. As things are, the Etruscan origins should be "dated back before the beginning of the Villanovian period, which might represent the Etruscan nation as already shaped and active" (Pallottino 1963:115). According to Laurenzi (1962:48), "no trace of populations being suppressed is to be found in protohistorical Etruria, but only a gradual transformation from a prehistoric culture to a Greek-like one. . . ." In other words, "the Villanovians might be archaic Etruscans" (Rittatore Vonwiller 1964:377).

THE VILLANOVIANS

Our data obviously concern only inhumed people, whose known number is constantly increasing, and these data are based on different series corresponding to the four stages of the Villanovian civilization in Bologna.

On the stage of S. Vitale (Villanovian I; ninth century B.C.) the remains, made up of five skeletons and three skulls, show a frequent brachymorphy, associated with a medium-short stature (158 centimeters; males). In two cases we note a flat occipital bone. Two of the three dolichomorphic types belong to male individuals of medium stature (160.3 centimeters and 165.9 centimeters); the third belongs to an individual of short stature, inhumed in a crouched position. Values of euroleny, platymeria, mesocnemy, and feeble pilaster have been obtained for the elements of the postcranial skeleton (Benassi Graffi and Facchini 1965).

The remains from the Benacci I and II stages (Villanovian II and III; 800–650 B.C.) are more numerous and are represented by skulls or calvariums and some fragments of the postcranial skeleton; these were partly described at the end of last century by Sergi (1884) and partly more recently by Benassi Graffi and Facchini (1972). The latter series, which is

the most numerous, shows a greater frequency of dolichomorphic types (nine cases out of thirteen), with values of mesocrany and orthocrany for the vertical and horizontal cranial indices. The other series (six skulls) is characterized by meso-dolichocrany (mean: 73.35).

We also have at our disposal the data connected with three recently studied skeletons and three calvariums from the Arnoaldi stage (Villanovian IV; 650–540 B.C.). The dolichomorphic remains are two versus four brachymorphic. The horizontal cranial index is of brachycrany in two specimens and dolichocrany in another (mean: 76.92). The face, preserved in the two dolichomorphic individuals, is high and ellipsoid. Indices of eurybrachy, euroleny, platymeria, and eurycnemy have been obtained for the postcranial skeleton. The femoral pilaster is middle-sized. The stature of the two dolichomorphic individuals is medium-short (160.3 centimeters; 163.7 centimeters).

To these data should be added that for a skull for which Sergi (1884) obtained a value of ultradolichocrany (63.9).

On the whole, a remarkable polytypism results in all the Villanovian series. In particular, we consistently find, with even some preponderance in the S. Vitale stage, the brachymorphic type, with moderately low skull, curved occipital, and rather short stature, comparable to the Alpine race. Along with it, we also find a stenomorphic type, which can be attributed to the Mediterranean race, represented by some particular groups, the specimens having moderate dolichomorphy with rather broad frontal bone and medium stature, which can be found in the Benacci and Arnoaldi stages.

The little data we have may even suggest a different frequency of the various types in the population belonging to the Villanovian stages; in particular, the stenomorphic types tend to increase from the S. Vitale stage to the Benacci, in which we found a type of ellipsoid, very long skull that had not been found in the past periods. Nevertheless, the brachymorphic and dolichomorphic types tend to be equal in the Arnoaldi stage.

THE ETRUSCANS

The data so far on the Etruscans from Felsina are drawn from a few series of skulls, described by Calori (1873), Sergi (1884), and Frassetto (1907), who also included the previously examined series in his study.

According to Frassetto, the skulls from Felsina can be attributed partly to the "Eurafrican" shape (twenty-two specimens) and partly to the "Eurasic" one (twenty-one specimens). The horizontal and vertical cranial indices show average values, respectively, of mesocrany (79.81) and orthocrany (71.57). The stenomorphic types correspond to the Mediter-

ranean type; the brachymorphic types with curved occipital bone are to be included in the Alpine one. Both the former and the latter also have a prevalently moderate height.

There are also some rare brachymorphic specimens with flat occipital bone, which can be compared to the Dinaric race (see also Frassetto 1932:8). Moreover, the author remarks (1928), in Padan Etruria there is a larger percentage of brachymorphic types than in central Etruria.

To the mentioned data we can add some more that we have obtained from a recent study (Facchini and Evangelisti 1975) of twelve Etruscan skeletons from Bologna Certosa, whose skulls had been partly described by Frassetto (1907). We give a short report on these data because it is the first study on complete Felsina skeletons.

The remains are of eight adults, two children, and two infants. The adult individuals seem to consist of four females and four males. Their characteristics can be summed up as follows: brachymorphic (five sphenoid, one pentagonoid) and dolichomorphic (three ellipsoid, two ovoid) shapes; horizontal cranial index in the adults of 77.11 (five observed:72–89), with individual values of dolichocrany and brachycrany; vertical cranial index of 76.4; high or large face.

An examination of the postcranial skeleton reveals a particular strength of the upper limbs in female subjects. In addition, we have obtained more frequent indices of eurybrachy, platymeria, and eurycnemy; the femoral pilaster is feeble or absent. The brachial index is of mesocercy in two females and brachycercy in two males. The tibiofemoral index acquires values of dolichocnemia (two observed) and brachycnemia (two observed).

The male stature is between 155.2 centimeters and 168.9 centimeters (mean: 162.7 centimeters) and the female between 143.8 centimeters and 158.2 centimeters (mean: 152.4 centimeters).

On the whole, the Certosa series shows clear heterogeneity because elements corresponding to either the Mediterranean or the Alpine race are present there. In particular, in addition to dolichomorphic individuals with an ellipsoid or ovoid cranial shape and a middle stature, there were found individuals with sphenoid skulls. A brachymorphic individual with a probably flat occipital bone and not particularly high stature should also be noted.

The series from the Marzabotto necropolis could also be of remarkable interest for the Bologna territory if its chronology were better defined, since that necropolis includes Gallic tombs along with Etruscan ones.

In spite of uncertainties that compel us to make some reservations in our interpretation of the data, we can state that mesocranial (seventeen) and brachycranial individuals prevail in the numerically large series of thirty-nine specimens (Lama 1947); this has also been observed in the Felsina skulls.

GENERAL REMARKS

We are not willing to draw conclusions about the relationships between the Villanovians and the populations which previously lived in the same territory and also resemble the Villanovians, especially in their racial heterogeneity. We would rather take up the problem of the relationships between Villanovians and Etruscans, about which our data provide enough information to allow us to formulate some hypotheses. This problem, which makes certain clear analogies especially between the remains from the latest Villanovian stages and the Felsina ones, is a very interesting one.

First of all, we should recognize a variety of types which, despite their different frequencies, are fundamentally the dolichomorphic, ellipsoid, or ovoid type of average stature (Mediterranean), the brachymorphic type with curved occipital bone and average or short stature (Alpine), and, possibly, also the brachymorphic type with flat occipital bone (Dinaric). In particular, we should remember that in the Benacci and Arnoaldi stages as well as among the Etruscans, we can observe dolichomorphic, ellipsoid, very long skulls, typically Mediterranean, and not to be found in the previous periods; moreover, the frequency of the dolichomorphic and brachymorphic types among Arnoaldi and Etruscan remains is nearly the same.

In addition, the data connected with the horizontal cranial index, which indicate a prevalence of dolichocranic types in the Benacci as compared with the Arnoaldi stage, seem to show a diminution of the index itself, passing from the S. Vitale stage to the following ones. The vertical cranial index shows more frequent values of orthocrany both in the Villanovians and in the Etruscans.

We also find some similarities between the Arnoaldi and the Etruscan remains, which are apparent in some indices of the postcranial skeleton, however small the number of the observations (euroleny, feeble pilaster, platycnemia, meso-eurycnemy), as well as in the stature, which is rather variable in the S. Vitale stage and tends to have average or average–low values in the Arnoaldi stage and among the Certosa Etruscans.

It should be noted that for the Arnoaldi stage we have very scarce data at our disposal; moreover, a sharper comparison between the various series will be made when other Etruscan and Villanovian skeletons, which have recently been recovered, are studied on the basis of an increased number of observations. A comparison with the series from other sites in northern and central Etruria (Spina in particular), reveals some elements of agreement as well as some of differentiation; for example, the frequency of the brachymorphic type is less in the non-Felsina series.

However, the anthropological heterogeneity in the Bologna Villano-

vian stages is well documented; and it increased in the Benacci and Arnoaldi stages, which are marked by the appearance of some, probably new, element. Such heterogeneity is also found in the Etruscans and can be connected — as we have remarked in a previous work (Benassi Graffi and Facchini 1972) — with relationships with neighboring regions, mainly those south of the Apennines, where important centers of the Villanovian and, later on, of the Etruscan culture flourished.

Moreover, the data at our disposal seem to point out some affinities between the Villanovian series, mainly the Arnoaldi and the Felsina, and suggest the hypothesis of a relative continuity between the anthropological Villanovian stroma and the Etruscan one. Therefore the populations which are historically called Etruscan might have been, in large part, preexistent in the Bologna territory.

It is to be remarked that such a hypothesis fundamentally is in accord with the autochtony theory of the Etruscan people and agrees with Messeri (1953), who suggested that a particular anthropological differentiation of the Etruscans, as regards the local populations, is not demonstrable in central Etruria.

We do not want to deny that during the Etruscan period — as well as in the previous ones — there were contributions of both ethnic groups and cultural elements from other neighboring regions or from eastern Mediterranean areas; the brisk commercial relationships with the centers south of the Apennines and with the regions of the Adriatic sea and Greece suggest that contributions from such areas were possible. Nevertheless, such contributions might not have modified the anthropological table that had been forming in the Villanovian stages.

We should finally remark that the ethnic and cultural problem of Etruscan origins remains within the hypothesis of autochtony; it is just shifted back in time. This problem should be connected with the one of ethnic Villanovian formation and with the general features of the proto-Villanovian period.

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Man in the Italian Alps: A Study of the Pleistocene and Post-Glacial Evidence

F. G. FEDELE

Fresh fieldwork by different scholars is giving a new start to prehistoric research in Northern Italy and is providing relevant data on the presence and life style of Paleolithic and more recent communities in some parts of the Alps. These data, however, have not yet been interpreted in the light of a "man–mountain" problem. On the other hand, multidisciplinary research on some samples of populations living within the Italian Alpine territory has been recently undertaken, in an attempt to clarify aspects of the interrelations between man and the mountain habitat (Chiarelli and Fedele 1969; Fedele 1971a; Masali, Rabino Massa and Fedele 1972; Lasker et al. 1972).

Problems concerning man–mountain relationships arise for contemporary as well as for Pleistocene times. Variations in these relationships during the Pleistocene have to be studied particularly against the background of the oscillatory conditions of that period, both local and general, i.e. in a "diachronic" perspective. The Alps are one of the major high mountain systems in the world, so we may assume they form a relief area suitable for penetrating research into this subject.

Only the southern side of the chain is dealt with here. This arbitrary break is merely contingent, for while a fundamental unity of the Alps as regards human ecology is acknowledged, any attempt at a more comprehensive synopsis is felt to be rather premature.

This paper is simply a tentative and problem-phrasing introduction to the subject under study. More space is given here to the discussion of the Paleolithic record, since it is in this field that the most innovative data have been gained. This may result in an unbalanced presentation, but

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"mountain" Paleolithic has been so rarely made the object of more than passing and vacant consideration that a formal reappraisal is thought stimulating. The following heuristic assumptions are central to the research to which the present writing is a contribution: (1) man-mountain relationships should be singled out as a topic of its own forming a *distinct* problem; (2) these relationships should be viewed according to the concept of an environmental *system* with its inherent interactions (D. L. Clarke 1971; Fedele i.p.b.).

These topics are discussed in three sections. Attention will first be given to what "mountain" means in the present context, both ecological and geographical. Then the relevant archeological evidence will be critically reviewed. In the last section, some anthropological and paleoecological considerations developed in this survey and by current research will be presented.

MOUNTAIN BIOTA: THEIR ESSENTIAL CHARACTERISTICS

Mountainous environments have no clear-cut lower boundaries. Nevertheless, the specific physiognomy they display immediately after a "transitional" zone justifies putting forward an overall definition of them. The valuable description of the high-altitude environment by Clegg, Harrison and Baker (1970) may be appropriately used to supplement our brief account.

This definition encompasses at least three major, distinct classes of environmental abiotic attributes: (1) *geomorphology* — or the values and the combination of small/large-scale landform attributes; (2) *altitude* — a merely metric feature relative to the atmospheric layers; and (3) *climatology*, with particular consideration for its diachronic dynamics in the past. Morphological and metric attributes are the most immediate markers of mountain; the others rather show a relative shading of values, and the variables involved become effective at different points. For example, the hypoxy gradient — one of the few environmental stresses man cannot mitigate by cultural means — becomes truly relevant only above 2,000 meters.

Altitude is generally associated with rugged terrain, but this is not always the case. Other factors affecting high altitude areas are combinations of low temperature, high precipitation rates, and high weather variability. In general, a mountain can be defined as any distinctly elevated, relatively uneven area, with significant climatic differences from any area below.

Mountain environments coincide with a distinct set of biota. Mountains provide a hard environment for every kind of living being, humans included. This holds true for high mountains, but also for rugged lands of

lesser height, where other sets of restrictions for habitation prevail. In general, animal populations are most affected by the adversity of mountain environments. As absolute and relative altitudes increase, the number of species drops and that of individuals per species rises; but on the whole, animal population densities tend to decrease and high mountains are virtually devoid of animal life above a certain elevation. This fact conditions the carrying capacity of (especially pre-agricultural) human ecosystems. One may use the term "bio-repulsive factors" for the constraints assumed to be responsible for this inhospitality.

Photosynthetic CO_2 fixation is enhanced by hypoxy, but the vegetation growing season is very reduced and snow cover severely limits the availability of food and of nearly every important raw material. Highly seasonal life cycles become the rule. The lack of wood for fuel may be in some instances a notable limiting factor, unless other cultural devices are applied. One of the more common characteristics of this type of environment is not so much the extreme nature of particular physical or biotic traits, but rather the amplitude of the seasonal variations in energy flow. Immaturity, and thus a continued instability, of the total ecosystem results.

Under such circumstances, some prehistoric populations found in pastoralism an advantageous way to inhabit and exploit mountain environments. In a sense, they used animals as energy exchange intermediaries, biologically suited to subsist on the more or less meagre resources of the ecosystem.

NORTHERN ITALY AND THE ITALIAN ALPS: PHYSIOGRAPHIC BACKGROUND

This paper is concerned with the relief area on the inner side of the Alpine range, from Liguria in the west to its Giulian tract in the east (Blanchard 1952, 1954; Sestini 1957; Dainelli 1959; Walker 1967; Veyret and Veyret 1967; Nangeroni 1967). The essential geographical feature of the chain is a nearly 200° arched, dead-end enclosure, relatively open toward the east with potential barrage conditions toward the west. The highest peaks in Europe are here: Gran Paradiso, 4,061 meters; Mt. Rosa, 4,633 meters; Mt. Blanc, 4,810 meters.

The Alps are considered to begin west of the low altitude Cadibona Pass, which connects the Po Plain with the Ligurian Riviera; to the east the Apennine range begins. It is lower and narrower than the Alps and has quite different geological characteristics. The Italian Alps are conventionally divided into many segments whose names still reflect to some extent the former presence of mountaineers who settled there in protohistoric times (the first millennium B.C.). As an overall subdivision

closer to the actual physiographic characteristics, the following major divisions can be considered: (1) the *Western Alps*, from the Ligurian tract to the Ticino–Simplon furrow; (2) the *Central Alps* to the Adige–Resia Pass furrow; and (3) the *Eastern Alps*, which dwindle into the Slovenian highlands.

The western segment of the chain is very high and narrow, with huge offshoots opposing each other on either side of the ridge. It is distinguished by a remarkable dissymmetry between its sides. The Piedmontese side is definitely shorter and steeper than the French one, as a result of the peculiar thrusts that acted here in Alpine orogenesis. The mean distance between the watershed and the plain's border averages only 45 kilometers, and the relief/plain fillet is commonly sharp.

The Western Alps coincide with the upper Po river basin and are very evenly segmented by the fan-shaped headwaters of the Po itself and of its drainage system, the largest in Italy. The Po alluvial plain is remarkably level throughout; the surrounding relief generally emerges from it in a very clear-cut shape. The Po Plain surface is only interrupted by the low, undulating or fragmented, Monferrato-Langhe Plateau in the central and southern Piedmont region, which is linked with the Apennines; and by the isolated Berici and Euganei hills in the Veneto. Pleistocene conoids and end moraines edge the contour of the plain and in several areas encircle the local foothills, making the transition to the relief less sharp.

A great number of streams descend from the Central Alps and join the central axis of the Po, but they do not follow the regular rayed pattern observed in the western part of the basin. Such irregularity has its roots in the regional morphology; the Central Alps form a large region of quite tangled design, with multi-oriented valleys and differently dissected plateaus. The Adige River is second in size to the Po and cuts through the alluvial plain parallel to it. Beyond the Adige furrow to the east, the rivers descending from the Eastern Alps flow out individually into the Adriatic Sea.

The bulk of the Alps along its main axis is essentially built up of crystalline rocks, with the exception of the Ligurian and Maritime segment where sedimentary lithology is dominant. In front of the inner edge of the Central and Eastern Alps, and throughout their extension, a fringe of lower relief stretches out in which Mesozoic and Tertiary carbonate formations are the common component; this is the Pre-Alps. Morphology and elevation of the Pre-Alpine belt are much varied; as a rule an overall uniformity may nevertheless be recognized, with respect to both the alluvial plain and the higher mountains behind. Where dolomites and certain types of hard limestones are exposed, cliff morphology predominates (cf. Sparks 1971:226 and 241–242). It is pertinent here to remark that this condition is quite frequently associated with the existence of caves and shelters with archeological potential.

Alpine compactness is broken by many local discontinuities. These are created by valleys and lakes, which ultimately join corresponding watershed sinkings and passes. The gouging done by the Pleistocene glaciers is easy to see. Major valleys represent an effective digitation of the plain environments into the mountain territory right to the feet of the highest relief, where peaks ascend abruptly. Despite some obvious influences from the surrounding mountains on intermontane valley microclimates, the ecology of these eccentric strips of elevated plain matches more or less closely that of the Po Plain itself.

Moving eastward, the major valleys and the altitudes of the main valley-head towns and their shortest distance from the Alpine drainage divide are (1) the Susa Valley (Susa, 500 meters, 10 kilometers); (2) the Aosta Valley, run through by the Dora Baltea River (Aosta, 580 meters, 15 kilometers); (3) the Ossola and the Upper Ticino Valleys, continuing respectively the western branch and the northern end of Lake Maggiore (Domodossola, 270 meters, 20 kilometers; Bellinzona, in the Swiss canton Ticino, 230 meters); (4) Valtellina, a longitudinal valley run through by the upper Adda River, continuing Lake Como (Sondrio, 300 meters, 20 kilometers); and (5) the long and straight Adige Valley (Trento, 190 meters; Bolzano/Bozen, 265 meters; Merano/Meran, 310 meters, 15 kilometers).

The main passes (Carandini 1961) are, west to east, Tenda, 1,908 meters; Maddalena or Argentière, 1,996 meters; Monginevro/Montgenèvre, 1,854 meters, and Moncenisio/Mont Cénis, 2,084 meters, to the Susa Valley; Little St. Bernard, 2,188 meters; Great St. Bernard, 2,473 meters; Sempione/Simplon, 2,005 meters; San Bernardino, 2,065 meters, to the Ticino Valley; Resia/Reschen Scheideck, 1,507 meters, and Brennero/Brenner, 1,375 meters, to the Adige Valley; and Predil, 1,156 meters. Many others which are unimportant now were probably crossed by prehistoric mountaineers (Laviosa Zambotti 1950; Bocquet 1968; Agavit 1969; Barfield 1971), as historical records show for the Western Alps in later times (Gribaudi 1928; Sestini 1957; De Lavis-Trafford 1960; Barocelli 1968; Prieur 1968; Agavit 1970).

The main factors in the climate of the Alpine area (Sestini 1957; Mennella 1967) are its elevation and exposure, which are highly varied from place to place. The climatic features of particular interest are low summer temperatures; a lessening of thermal amplitudes as altitude increases; a stronger solar radiation; higher air dryness; abundant rains (summer maxima); abundant snow precipitation from autumn to spring; and snow cover persistence for a half to three-quarters of the year. But these characteristics are more or less common to all mountainous regions of the temperate belt. The snow line in the Italian Alps commonly ranges between 2,500 and 3,000 meters.

A peculiar phenomenon is brought about by *föhn* winds, i.e. a rapid

and durable temperature rise which is produced by either northward or southward currents on the lee side of a chain (Perrill 1970).

The Pre-Alpine climate is more humid and rainy and has higher and more constant temperatures; this is partly the result of the presence of large lakes. Over the years, these lacustrine environments also exerted considerable attraction and influence upon man's dispersal into this area.

A REVIEW OF THE CULTURAL EVIDENCE

At present, research is still at the stage of assembling the basic factual evidence. Analyses and evaluations to supply firm data for "human paleoecological" reconstructions are severely limited and related "model" building is in its absolute infancy. The evidence available for the earlier times is archeological and paleoenvironmental, and generally is very meagre as far as the Alps are concerned. Historical sources may add valuable information from classical times onward, but a gap persists in the evidence between the end of the documented Roman period and the conditions which we are still witnessing today.

North Italian prehistory has been recently and competently summarized by L. H. Barfield (1971). For reviews, particular periods, areas or problems, the following surveys may be consulted: Leonardi 1957, 1963; Leonardi and Broglio 1965; Barocelli 1960; Pittioni 1962; Radmilli 1962, 1963; Broglio 1967, 1971, 1972a; Barfield and Broglio 1971; Fedele 1966b. A detailed review of Barfield's book is also available (Fedele 1973d).

Relevant though preliminary information is graphically conveyed by Figure 1 and Maps 1 to 3. These distribution maps must be used with caution, since in the present state of knowledge the overall pattern intensities and regional diversities may be affected considerably by sampling error.

Lower and Middle Paleolithic

PALEOECOLOGICAL BACKGROUND. Sites assignable to Lower and Middle Paleolithic stages are very rare in Northern Italy in general and absent from the core of the Alps in particular. But the view once held that their lack was caused by actual inhospitality due to the severe adversity of climate during much of the Pleistocene period is no longer tenable. A number of discoveries can be expected in the forthcoming years as proper scientific research focuses upon the problem (Fedele 1966b; Blanchard 1952:294); recent developments, to be discussed later, lend strong support to such expectations.

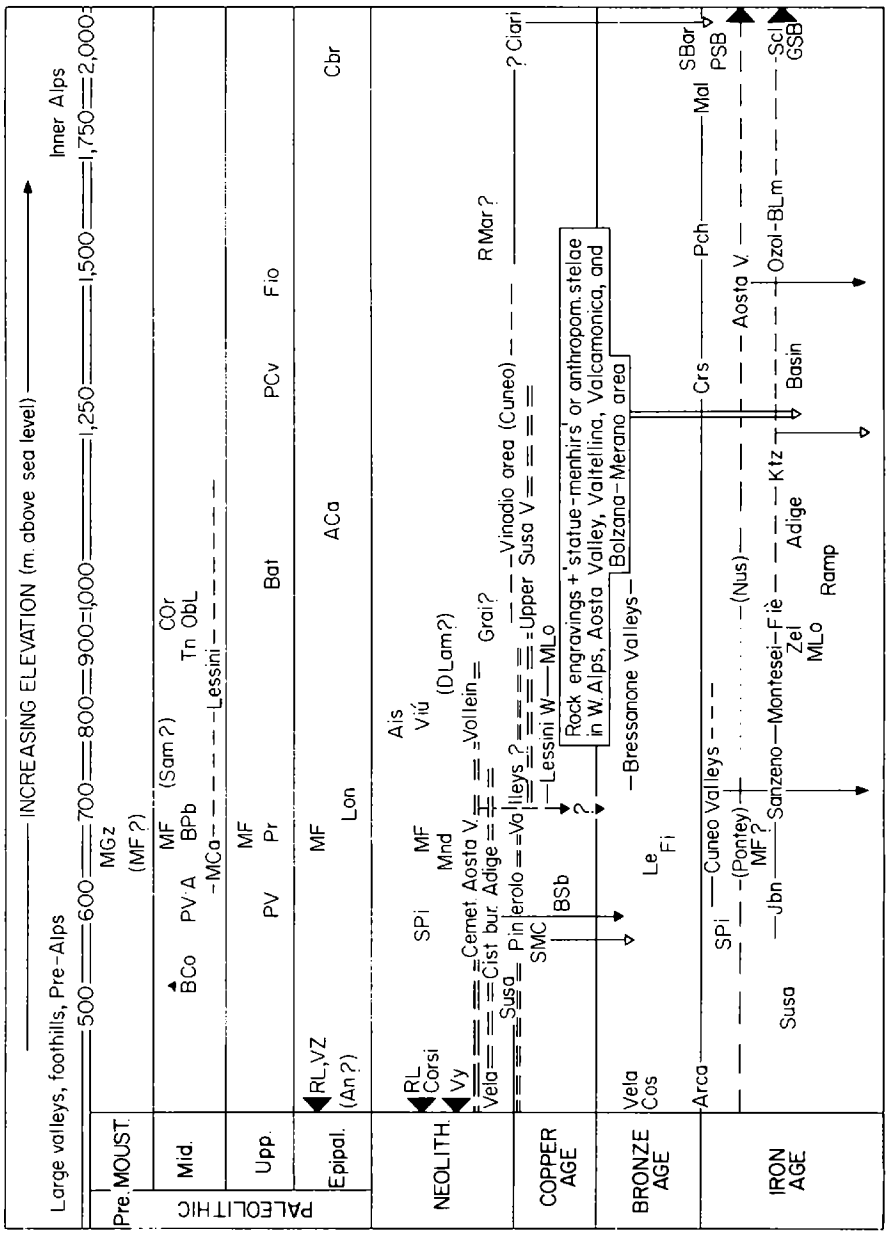


Figure 1. Distribution of main archeological sites according to their altitude above sea level (from the sources quoted in the text)

General Legend for the sites recorded in Figure 1 and in Maps 1 to 3

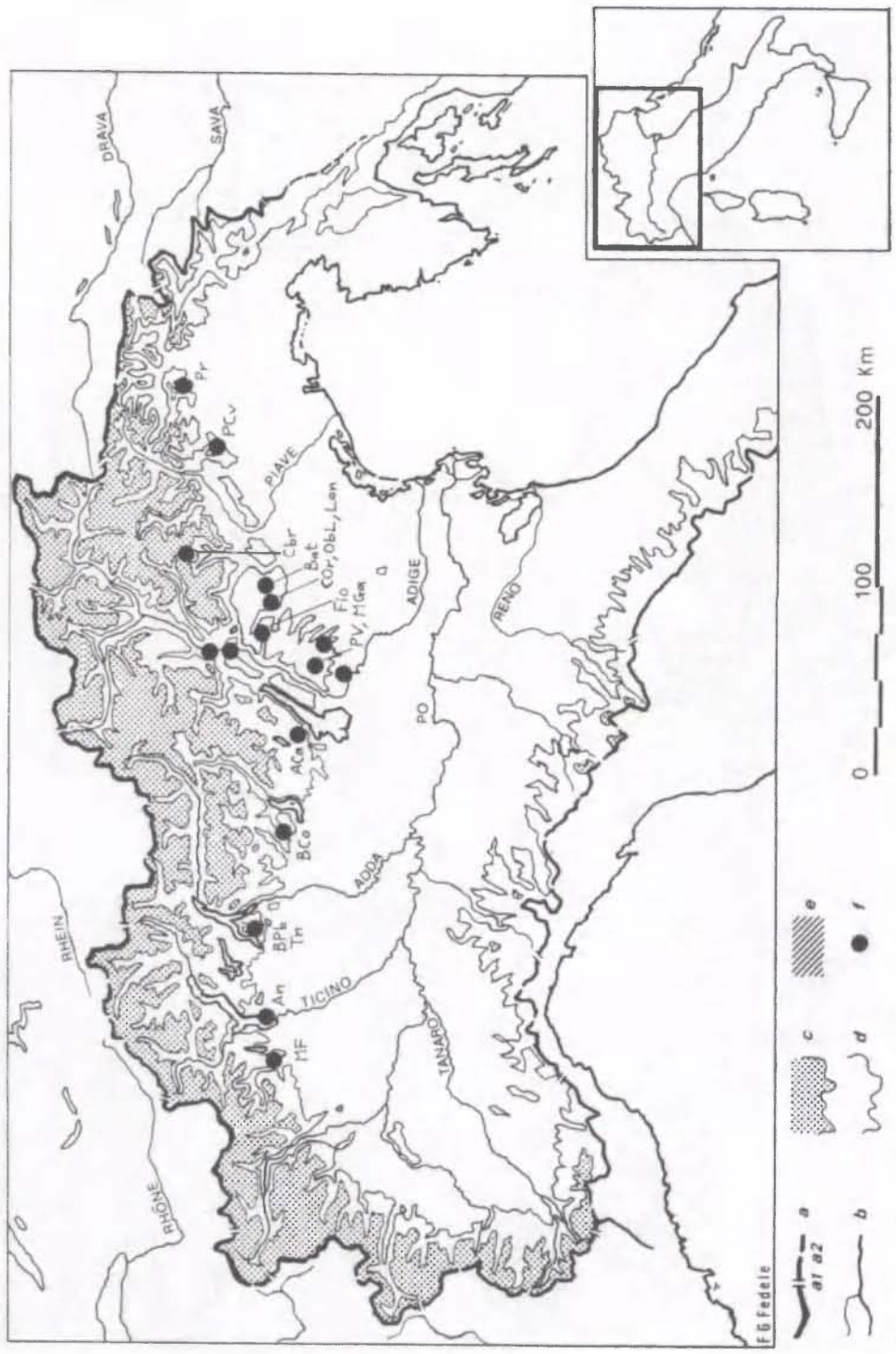
ACa Cariadeghe plateau, W. of Lake Garda, Lombardy
Ais Aisone Cave, Stura Valley, SW Piedmont
An Angera Cave, E. shore of Lake Maggiore, Lombardy
Arca Dos dell'Arca hill-site, Valcamonica, Lombardy
Bat R. Battaglia Shelter, Asiago plateau. 1050 m
BCo Buco del Corno Cave, Cavallina Valley, Central Lombardy
Blm Bellamonte hill-fort, Val Travignolo, Trentino. 1548 m
BPb Buco del Piombo Cave, W. Lombardy. 695 m
BSb Buco della Sabbia Cave, near Civate, NW Lombardy
Cbr Colbricòn open-air sites, near Rolle Pass. 1900–1950 m
Ciari Gias del Ciari Shelter, Mt. Bego, SW Piedmont/France. 2100 m
COr Cava degli Orsi (or del Bisele) Fissure, Asiago plateau. 950 m
Corsi Ai Corsi di Isera open-air site (hill), S. Trentino
Cos La Cosina Cave, Cavedine Valley, W. Trentino
Crs Crissolo, Turin province, Piedmont
DLam San Donà di Lamon, Central Veneto. 885 m
Fio I Fiorentini open-air site, Tonezza-Folgaria plateau. 1482 m
Fi Fiavè peat-bog site, SW Trentino
Grai Arma del Grai Cave, Cuneo province, S. Piedmont
GSB Great St. Bernard Pass. 2473 m
Jbn Colle Joben (Jobenbühel), Bolzano area. 609 m
Ktz Colle Katzenlocher, Bolzano area. 1164 m
Le Ledro Lake sites, SW Trentino, W. of Garda Lake. 650 m
Lon Covoli di Lonedo cave sites, Asiago plateau
Mal Malciaussià Lake, Upper Viù Valley, Piedmont. 1850 m
MCa Monte Calvarina, E. Lessini Mountains
MF Monfenera site system, N. Piedmont — MF1 Ciutarùn Cave; MF2 Ciota Ciara Cave; MF4 Belvedere Shelter. 650–700 m
MGz Monte Gazzo, Lessini Mountains
MLo Monte Loffa open-air site, Lessini Mountains
Mnd Grotta del Mondo cave site, Lessini Mountains
ObL Obar de Leute Cave, Asiago plateau. 950 m
Ozol Caslìr di Monte Ozol, Val di Non, Trentino. 1513 m
Pch Pontechianale-Castello, Varaita Valley. *c.* 1550 m
PCv Piancavallo open-air site, Central Veneto. 1300 m
Pr Pradis Cave, NE Veneto
PSB Little St. Bernard Pass. 2188 m
PV Ponte di Veia cave system, W. Lessini. 602 m
Ram Ciaslè di Ramponio, Val d'Intelvi, Lombardy. 1045 m
RL Loc di Romagnano cliff-foot sites, I–III, Trento area
RMar Balma di Rio Martino Cave, W. Piedmont. 1525 m
Sam Grotticelle di Sambughetto Valstrona cave site, N. Piedmont. 760 m
SBar St. Barthélemy, Aosta Valley, *c.* 2000 m
Scl Mt. Sciliar/Schlern, Trentino. 2520 m
SMC St. Martin-de-Corléans, Aosta. 585 m
SPi St. Pierre, Aosta area
Susa Susa area, Susa Valley. 500–520 m
Tn Tanùn Cave, W. Lombardy. 900 m
Vela La Vela di Trento, Trento area: 1. open site; 2. shelter
Viù Versino di Viù open-air site. Viù Valley, W. Piedmont. 820 m?
Vy Vayes "Shelter," Susa Valley, Piedmont
VZ Vatte di Zambana Shelter, Trento area
Zel Dos Zelor, Fiemme Valley, Trentino. 950 m

General Legend for Maps 1 to 3

Physiographic base map of Northern Italy:

a. Alpine-Apennine drainage divide; culminations simulated; passes: *a1* pass notably crossed in prehistory (adapted from Barfield 1971); *a2* other important passes.

b. Diagrammatic drainage network; the main component is the Po River system, its basin covering more than 70,000 square kilometers.



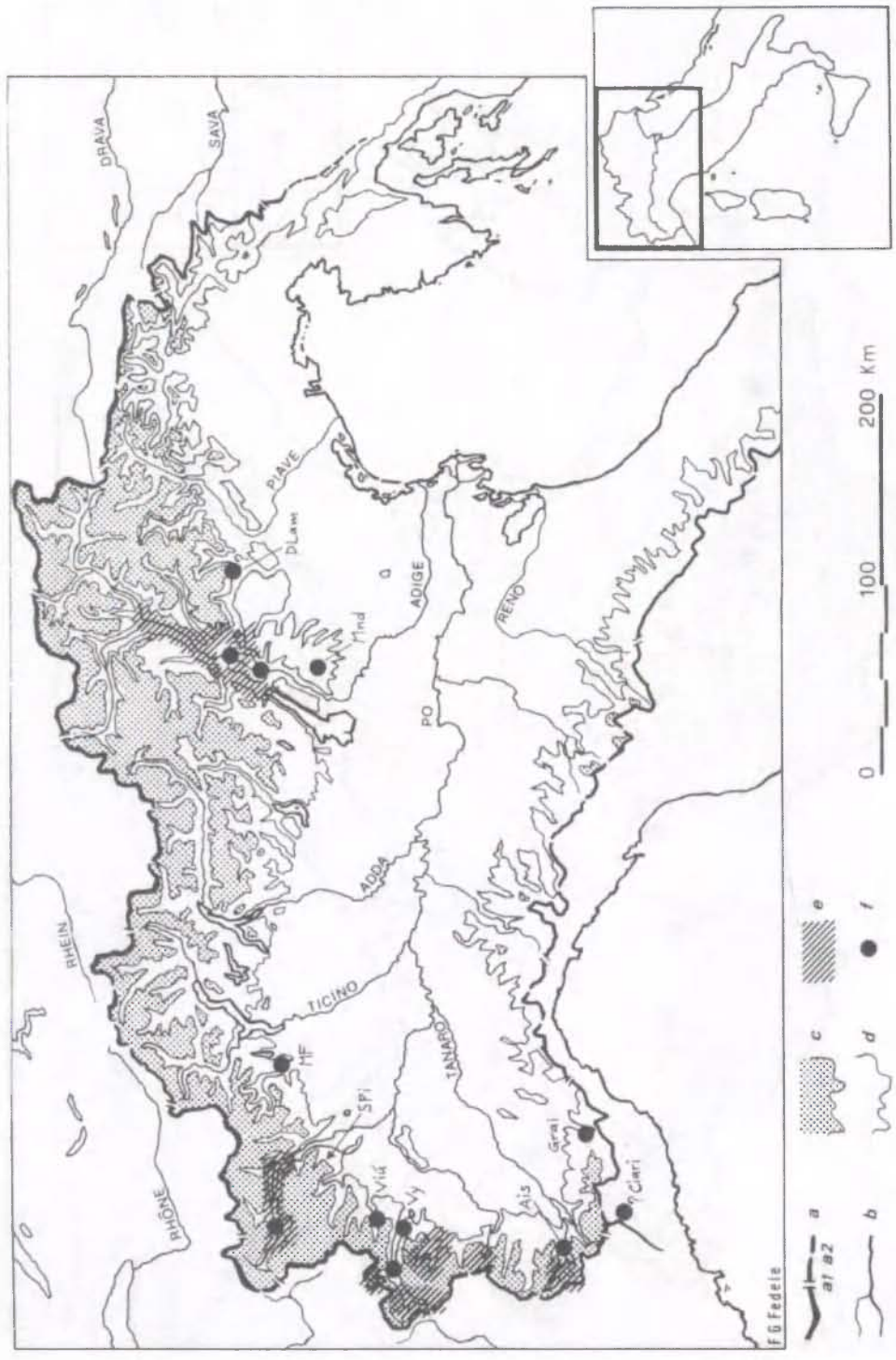
Map 1. Italian Alps, Paleolithic and Epipaleolithic sites

c. Elevation above 1,500 meters (at northern latitudes) or 1,700 meters (at southern latitudes).
d. Elevation above 500 meters (at northern latitudes) or 70,00 meters (at southern latitudes).

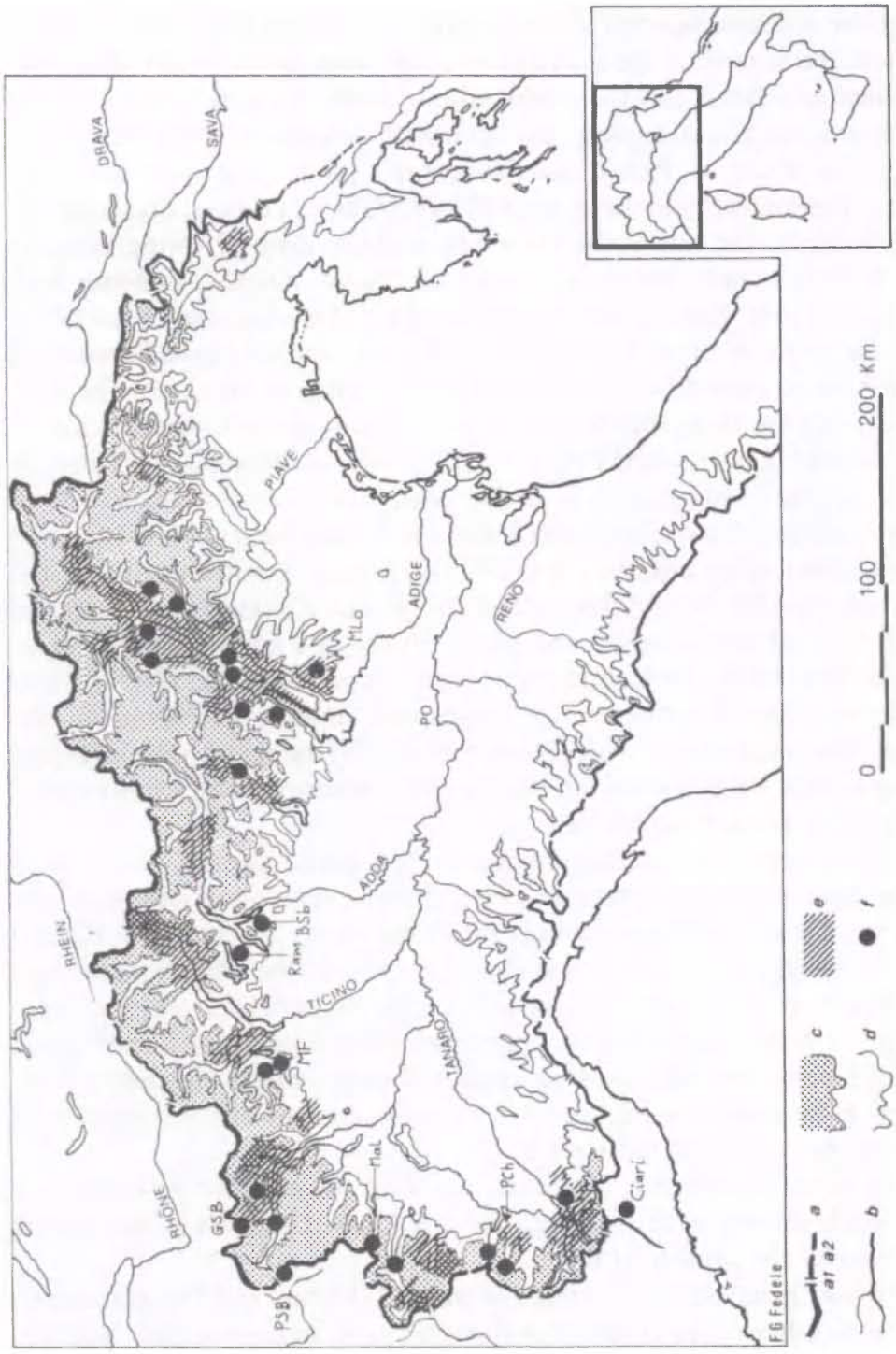
Distribution of archeological phenomena:

e. Distribution areas; surface scatters; or traces.
f. Major site.

On the index map the Italian administrative boundary, not the geographical, is shown.



Map 2. Italian Alps, Neolithic sites



Map 3. Italian Alps, Copper to Iron Age sites

This statement does not mean to minimize the size and the far-reaching consequences of the Pleistocene events in this area, however. The Alps fostered impressive glaciations on their southern side, beginning shortly after the Adriatic Sea had started to contract. At the end of the Pliocene period, the sea still extended westward into what is now the Po Plain and reached as a deep gulf the paleo-valleys of the Western Alps.

Pleistocene glacial geology has been well understood in Northern Italy since the times of Penck and Brückner's pioneering inspection and interpretation, early in the century (1909). Glaciers repeatedly increased in relation to the fall of the snow line and the drop of spring–summer temperatures and expanded toward the valley mouths, building high moraines there. For reasons of morphology and feeding, only a few of the glaciers in the Western Alps reached the plains and left signal deposits on their retreat, even if backed by the highest massifs in the chain. The Susa Valley and the Dora Baltea glaciers are the only remarkable instances in this respect (Carraro and Petrucci 1972; Carraro, Medioli and Petrucci, i.p.). In the Sesia Valley — to be seen later in connection with a Paleolithic locality — the glacier fed by Mt. Rosa's huge snow fields never attained the valley mouth (Sacco 1930). This is not, however, to say that glaciations in the West did not affect the general climate and the regional conditions of microclimate and practicability to a pronounced degree.

The glaciers in the Central Alps were especially large. Nearly every valley is bordered at its entrance by morainic systems protruding into the plain. The succession of valleys now occupied by the sub-Alpine lakes and the spacious Adige Valley (cf. Venzo 1965) is noteworthy. Lesser glacial effects are known farther east.

The consequences of fluctuations of Pleistocene glaciers on the landscapes are easily recognizable everywhere. Glacier-dependent stream regimens projected these effects far down valley to create rhythmical phases of aggradation and erosion which terraced the alluvial plain. As a further result, fluctuations of the water tables in both level and flow were reflected in the regimens of the springs which abound near the relief/plain contact, and were and are so important a factor of man's biotope choices. These facts should be evaluated, too, in the context of the feasibility of human movement in the terrain.

Coastline movements, in accordance with the eustatic oscillations of the sea level, were also strong; but this kind of process is not strictly relevant to the present study.

It is now generally agreed that the Mindel (Elster) and Riss glaciations on the southern side of the Alps were far more extensive than both the previous and the later ones. The earlier glacial events are still little known, while the Würm Glaciation is profusely documented nearly everywhere. It is quite apparent that its glacial termini did not surpass the Riss moraines (Venzo 1965). What is still badly needed — partly as a result of the immaturity of Paleolithic archeology in the area — is a

coherent framework of correlations between valley and plain fluvio-glacial sequences and the sedimento-climatic phases derived from the archeological deposits in caves (Fedele 1972a).

The Würm period south of the Alps seems to comprehend roughly two "glacial" subperiods parted by a milder interval (Pasa 1969; Fedele 1971b, 1972a); they will be referred to here as Lower and Upper Würm. Lower Würm starts strongly oceanic in character and remains to some extent that way for its whole time-span. Faunal associations comprise temperate species such as red deer, fallow deer, alpine ibex, chamois, cave bear, locally supplemented by marmot or even glutton. Vegetation cover is made up mainly of mixed pine and temperate deciduous tree species. The latter part of this subperiod is marked nevertheless by an increase in continentality and dryness and is characterized by a relative spread of grasslands and associations in which horse and hamster are numerically dominant. This subperiod can be correlated with the Würm I of central European periodizations (cf. Woldstedt in Rankama 1967; W.1^{E} in the present writer's notation) and E. Schmid's *Frühwürm* of the Swiss Alps (1958, and subsequent works). On the other hand it is to be correlated with the Würm I+II of F. Bordes and other recent French scholars (Bordes 1954; Valoch and Bordes 1957; Bonifay 1964; Leonardi and Broglio 1965; Lequatre 1966; Alimen in Rankama 1967; De Lumley-Woodyear 1969) and my W.1–2^{F}.

On the whole the Upper Würm shows a predominance of distinctly rigorous, continental climates. Cyclical events, such as wind deposits, congelifraction of flint artifacts or cryoclastic rubble layers are a recurrent feature of this subperiod. Coniferous woodlands, then willow–birch formations and open land tracts, became widespread. *Sicista*–hamster associations are typical in faunal assemblages. During the decreasing phase of this glaciation a shift towards the establishment of an impoverished mountain fauna (ibex, brown bear, snow vole) may be seen, eventually leading to the remnant faunas of today. Such a fauna is locally supplemented by elk and red deer. Cave bear bones increasingly reveal pathological degeneracies. This is quite probably the Würm 2 + 3^{E} as defined north of the Alps, Schmid's *Hauptwürm*, and Bordes's W.3 + 4^{F} (Leonardi and Broglio 1965; Fedele 1966a, 1968, 1972b).

The main Würm Interstadial (now renamed Hengelo-Quinson in Western Europe) seems to be marked by sedimentation pauses and soil formation, but it still raises many problems of definition and detail. In Northern Italy as well as elsewhere it generally separates Middle from Upper Paleolithic cultures (cf. Leonardi and Broglio 1966).

The Pleistocene climatology of this territory has been summarized haphazardly in relatively recent works (Mancini 1963; Follieri 1965; Marchesoni and Paganelli 1966; Bertolani Marchetti 1967; Pasa 1969; Charrier 1967, 1970), mainly discussing palynological contributions.

CULTURAL EVIDENCE. The Lower Paleolithic is sparsely represented in the Veneto region of northeastern Italy. Examples of the Abbevillian-like hand ax from Quinzano near Verona in the Plain are supposedly from a Riss interstadial. A few supposedly post-Riss, "Acheulian" hand axes and flake artifacts come from upper levels at Quinzano and from surface sites (Lughezzano di Valpantena) in the nearby Lessini Mountains, a harshly dissected but unelevated plateau (Zorzi 1959). Even the Mount Gazzo hand ax and other surface finds, despite some claims (Barfield 1971:20), has only marginal relevance to our theme. All over the Old World, Acheulian and Clactonian hunters frequented the low and mid-altitude plateaus (cf. G. Clark 1967; Collins 1969). The same pattern occurred in peninsular Italy (Radmilli 1963, 1964). But in fact all these old finds need to be re-examined in depth (Leonardi and Broglio 1965).

Elsewhere in Northern Italy, Lower and more generally pre-Würm Paleolithic sites are generally unknown (Leonardi 1957; Broglio 1967; Fedele 1966b). The only exception north of the Po, though remarkable, is a Late Acheulian campsite which is being investigated in central Piedmont at the time of writing (discovered in 1974; Fedele and coll., unpublished). The true status of three unretouched flakes found at Ciutarùn Cave on Monfenera in Piedmont cannot be assessed (Fedele 1974a, 1974b).

In summing up, the evidence for a pre-Mousterian human presence in the Italian Alps is all rather inconspicuous so far as man's first venturing into the true mountainous territory is concerned. The phenomenon is substantially the same all around the outer edge of the chain.

Demonstrable Middle Paleolithic sites are clearly more frequent than the earlier ones. They compose a well-known group in the Veneto region. West of the Lake Garda–Mincio line, on the contrary, in an area of 55,000 square kilometers, this stage is now reported from no more than a few scattered points (Fedele 1966b, a general survey; 1972b, 1973b, 1973c). Relevant sites are listed in Figure 1. All of them may be referred to variants of the Mousterian complex (in the current, Bordes' sense) and are roughly datable to the Lower Würm. Unfortunately, the information at hand for many of these sites is hardly adequate for the requirements of modern research.

The karst fissure site at Cava degli Orsi (Bears' quarry) and the Obar de Leute Cave, on the escarped Asiago Plateau in the Veneto region, yielded small collections of worn flint artifacts, which were claimed to be "Alpine" denticulate Mousterian. "Technical" Levallois indexes are rather high. Reliable stratigraphy could not be observed in either case; the faunal remains comprise cave and brown bear, wolf, red deer, marmot, and hamster (Leonardi and Broglio 1965; Broglio 1969b). Surface traces of probable Mousterian artifacts were collected extensively on Mt. Calvarina and elsewhere on the Lessini Mountains as high as 1,200

meters (Zorzi 1959, 1960; Radmilli 1962). But in many instances these finds are barely distinguishable from other surface flint debris more clearly pertaining to the Neolithic and post-Neolithic exploitation of the rich flint-bearing plateau. This fact should perhaps justify a little skepticism or prompt a reappraisal of the available evidence. There are other traces which come from Cave A, layers 5–6, at the Ponte di Veia, a remarkable complex of sites under a natural limestone bridge which is situated more inside in the Lessini area.

The Tanùn site demands different considerations. A handful of stone artifacts were found in Buco del Piombo and Tanùn Caves between the lower branches of Lake Como in the Pre-Alps of Lombardy (Leonardi 1957, 1963; Fusco 1958) as a result of unsystematic collections begun in 1935. Many flint and limestone flakes were thought to have definite "Paleolithic" features; this is likely to be true, but neither deposit deserves consideration as more than a mere "presence sign" (Fedele 1966b). The only clue to their chronological assessment was provided by a rather loose association with cave bear bones.

In 1971, it was announced that a denticulate Mousterian assemblage in a rich faunal context, including a human vertebra and two humeral fragments, had been found at Buco del Corno Cave, in the lower Cavallina Valley in Lombardy (Fusco 1971, and personal communications; cf. Fedele 1972b, 1973b).

The Monfenera site cluster in Piedmont is the westernmost Paleolithic locality so far discovered in Northern Italy. Moreover, it seems to be the only one which can substantiate more intimate inferences about man's early activity close to mountainous glaciated areas. On this cliffed mountain, dolomite walls between 650 and 700 meters above sea level, overhanging the Sesia *thalweg* by 350 meters, are carved into a belt of caves and rock-shelters filled with impressive deposits. In Pleistocene times this point was exposed several times to the nearby Sesia Glacier when it descended from the huge snow fields in the Mt. Rosa massif. Scientific investigations there did not begin before 1964, after decades of pillaging and sparse reporting. Currently it is proving very rewarding (Fedele 1966a, 1972b, 1973b, 1974b).

Regular excavations on Monfenera since 1966 have provided strong evidence for the existence of a "system" of close Stone Age sites. Stratified cultural sequences are now known which extend from the Middle Paleolithic to the Neolithic, the Iron Age, and up to the Late Roman and Early Medieval periods.

Definite Mousterian assemblages were discovered in Ciota Ciara Cave and at the Belvedere Rock-Shelter, and more recently in the surviving section at Ciutarun Cave. The number of Mousterian artifacts recovered from Monfenera sites may total 250 up to the present. At least two slightly different industries seem to occur. The first is well documented at

the entrance to the Ciota Ciara; it seems to be a non-Levallois, typical Mousterian industry, rich in sidescrapers and denticulate types. Nearly 95 percent of the artifacts are made of milky vein quartz, a quite remarkable choice; some cores were found (Fedele 1966a, 1973c).

The other industry is definitely represented in the richer levels of the Belvedere, 1967 test pit, layers 7–9, and probably in several levels of the Ciutarun "inner" deposit. It may be tentatively described as a *faciès denticulé* Mousterian (*sensu* De Lumley-Woodyear 1969) perhaps to be linked to a typical Mousterian industry (Fedele 1972b, 1973c). Among its most interesting recurring peculiarities are the great variety of good and inferior stones used for manufacture (vein quartz, many cryptocrystalline siliceous stones, porphyry), the scarcity of waste byproducts, the high frequency of microlithic or near-microlithic size, the non-incidence of Levallois flaking technology, and the abundance of use-chipped edges as well as of *pièces écaillées*. Excellent exotic flints have been exceptionally employed. Only a few cores have hitherto been recognized. Two bone *retouchoirs* and bone splinters with thin slicemarks due to flesh removal were found.

The artifact assemblages are commonly associated with selected mammalian faunas among which cave bear remains are prominent. At the Belvedere, megafaunal remains can be generally considered as cultural food refuse; they point to the game specialization of the Mousterian inhabitants (cave bear was supplemented to some extent by ibex, bison, and cervids), while the findings from the inner "chamber" of Ciota Ciara Cave better display the broader spectrum of the natural faunal environment (Fedele 1966a, 1968, 1973b). So, Monfenera as a whole affords a signal opportunity to study the internal patterning of a "close site system" and the much-debated problems of activity differentiation and "intergroup" vs. "inter-locational" functional variability (Mellars 1970; Bordes and Bordes 1970; Marks 1971).

Pollen analytical data from the Monfenera sites are still under laboratory processing.

A group of small caves cut by a quarry at Sambughetto Valstrona, in a valley 22 kilometers north of Monfenera, must be dismissed as Paleolithic sites on the basis of the present evidence (Fedele 1966b, 1973c). Nevertheless, many circumstantial signs suggest that a resumption of qualified field research there could eventually bring to light additional proofs of Mousterian penetration into the Western Alps (Maviglia 1952; Venzo 1954; Radmilli 1963; Fedele 1974b: Appendix).

In summing up, one is struck at first by the overall patterning of the geographical distribution of these sites, which show a remarkable alignment in the Pre-Alpine upland and foothill fringe. In Piedmont and Lombardy the sites being discussed are the only ones yet known, while in Veneto many others apparently exist closer to the plain. One may legiti-

mately suspect that west of the Veneto region this patterning is mainly due to inadequate investigation and differential "findability" which strongly favor the Pre-Alpine caves. (On the other hand, the numerous caves existing in southwestern Piedmont, at altitudes averaging 1,000 meters, have never yielded any Paleolithic material, so far as can be ascertained.)

If this distribution pattern reflects reality to any extent, the presumptive location of sites along transitional ecological zones or "ecotones" (cf. Harris 1969:8-9) with easy access to the resources of several different major eco-systems — rocky plateaus, middle mountain woodlands, floodplains — is worth taking into account.

Upper Mousterian assemblages from the Broion Cave, in the Berici Hills (Veneto), are radiocarbon dated on charcoal samples as follows: 44,450±1,500 B.C. (GrN–4637), 38,650±1,270 B.C. (GrN–4638) (Leonardi and Broglio 1966).

Upper Paleolithic and Epipaleolithic

Knowledge about the Upper Paleolithic and Epipaleolithic stages has rapidly increased in recent years as a result of lucky discoveries and thorough research in the Veneto and Trentino regions. During the same time, a major new focus was found on Monfenera in the northwest. Finally in 1971–1974 a few minor sites were reported in the intermediate territory and on the Emilian Apennines. Such an increase in knowledge ranks among the outstanding achievements in prehistoric investigation in Italy over the last decade. All the evidence now at hand is thoroughly summarized in the papers by A. Broglio (1967, 1969a, 1971, 1972a, 1972b).

Following Laplace–Broglio's nomenclature (Laplace 1966; Broglio 1969a), the Upper Paleolithic is almost exclusively represented in Northern Italy by the Epigravettian "complexes." This long-lived, backed micro-point tradition seems to continue the Gravettian culture with relatively unimportant changes far after its decline in France and elsewhere, and well into early Post-Glacial times. The Epigravettian tradition seems thus to be synchronous with the French Solutrean, Magdelenian, and Azilian cultures, linking Italy to eastern more than western European culture areas. Evidence of preceding Upper Paleolithic cultures (Aurignacian, Gravettian) is extremely rare and controversial in Northern Italy and not documented in the mountain area so far. An assemblage from Ponte di Veia Cave A was ascribed to a Châtelperronian-like industry (pending re-examination), while a few similar finds come from the nearby Grotta del Mondo.

The Epigravettian tradition is superseded at about the seventh millen-

nium B.C. by cultures that almost exactly match the Sauveterrian and the Tardenoisian cultures which are well represented in western Europe. In the fifth millennium B.C. — or a millennium earlier if the tree-ring calibration chart for radiocarbon measurements is accepted — a local "neolithization" now seems to have occurred in the eastern Po Plain, grafting pottery manufacture and early cereal agriculture into a late Epipaleolithic/Mesolithic (Tardenoisian) lithic industry (Broglio 1972a).

Valid evidence of man's presence on the inside of the Alpine mountains first emerges at the Upper Paleolithic stage of culture. This evidence consists in the first place of Epigravettian assemblages which were found at Ponte di Veia, Caves C and E, and irregularly at Pradis Cave in the Friùli province. But the most striking information is provided by the series of open-air and rock-shelter sites located well above 1,000 meters in the Central Veneto uplands, from the northwestern end of the Asiago plateau to the Cansiglio near Pordenone. The R. Battaglia Shelter (1,050 meters) and the sites at Fiorentini (1,482 meters) and on the Piancavallo Flats (1,300 meters) fall within geological contexts which suggest that the local Würm 3^E ice sheets had begun to retreat just a short time before. When Late Paleolithic hunters pushed as high as Fiorentini, for instance, wood cover had not yet re-ascended so far. The distribution patterning of flint tools and trimming waste at the R. Battaglia site has been taken to show that an encampment of huts or tents was aligned along the limestone cliff foot on the surface of Late Würm aeolian deposits. Faunal and other direct environmental data are unfortunately lacking for all the sites. But the tool-kits themselves certainly point to intensive, perhaps specialized and seasonal, hunting activities (Bartolomei and Broglio 1967; Broglio 1969b; Bartolomei, Broglio and Gaspardo 1971).

All the mentioned assemblages are assignable to the Evolved Italic Epigravettian (Broglio 1969a, 1972a). The artifacts comprise burins, short endscrapers, backed and hump-backed points, simple-backed bladelets, and truncatures. A comparison with the radiocarbon-dated series of the Veneto (Tagliente Shelter near Verona) may put this phase in the eleventh to tenth millennia B.C.

In all northwestern Italy the only locality which has hitherto supplied a comparable clue is still the Belvedere Shelter on Monfenera (Fedele 1971b, 1972b, 1973c; Broglio 1972a). So far the Belvedere only yields evidence of repeated but rather erratic visits by small Upper Paleolithic groups. There undoubtedly are signs of human presence well into an early phase of Upper Würm, but a cultural specification is not yet possible. Three deposits have given evidence of such undefined Upper Paleolithic industries on Monfenera so far. Later on in the series, two more definite assemblages occur which are seen best assignable to an Epigravettian very like that of the Veneto plateaus. Bilateral-backed bladelets, arched-backed points, and rough endscrapers, commonly made of choice exotic

flints, are reported. Affinities with the Veneto region especially point to the Evolved-Terminal Epigravettian assemblages such as Piancavallo, where for instance protogeometric microliths appear. One may therefore predict that a notably complete, though numerically poor, Upper Paleolithic sequence is documented at the Belvedere Shelter.

One must also foresee, in our opinion, that other Epigravettian and Epipaleolithic resting places and camps will be found on the mountains which surround Monfenera. This assumption leads us to the Epipaleolithic evidence. In fact, few flint microliths from Angera Cave and the Cariadeghe karst plateau, at the opposite ends of Lombardy and in similar situations to Monfenera, are now reported and referred to this culture period on Broglio's authority (Broglio 1972a; Biagi 1972; cf. Fedele 1972b). In the northeast, the Epipaleolithic is mainly known from the important deposits of the Adige Valley, Vatte di Zambana and Loc di Romagnano III, near Trento. The latter is a true "key-site," containing a series which extends with remarkable continuity from a Sauveterrian-like to a Tardenoisian-like layer, up to "Pottery Epi-Tardenoid," Neolithic (different horizons), and the Bronze Age (Perini 1971b; Broglio 1971, 1972b). More recently, Epipaleolithic sites have been discovered high on the Emilian Apennine ridge (Cremaschi and Castelletti 1973).

In 1971, Sauveterrian-like assemblages were recovered between the two small Colbricòn lakes in the vicinity of the Rolle Pass at about 2,000 meters elevation (Bagolini 1971), in close association with hearths (Bagolini 1972b; Dal Ri 1973). Findings such as Colbricòn have brought the southern side of the Alps into the wider picture already emerging from foreign circum-alpine discoveries: Isère (Bocquet 1969), Savoye, Switzerland (Bandi 1963; Egloff 1965), and Slovenia. The latest hunter-gatherers in this territory did not turn to the sorts of mixed subsistence economies apparently documented in the coastal regions to the south, but relied more and more on evolved hunting/gathering practices of a late Paleolithic type, in which high mountain resources evidently gained a substantive role. (The term Mesolithic is therefore avoided, as far as the Alps and the Po Plain are concerned.) This process seems to be almost exactly replicated in the Pyrenees and in the Central Massif area of France, and should be investigated in further detail.

Neolithic

The case of a transition from indigenous Tardenoid substrata to the Neolithic in a technological sense, mentioned above (Loc di Romagnano III, layers AA1-2), is still rather isolated. Ongoing excavations of Gabàn Rock-Shelter, in a suspended valley near Trento (Bergamo Decarli et al.

1972), will certainly supply important new information on the Tardenoid and Early "Neolithic" cultures in the northeastern Alpine region.

The well-known Neolithic culture whose lithic component has a clear Epipaleolithic ascendancy (Fiorano culture) was settled in the Emilia region far from the mountains; only scattered imports reached Romagnano and probably other sites in the Adige Valley (Bagolini 1972a; Broglio 1972b). (So far, radiocarbon dating puts the Fiorano culture between 3,900 and 4,400 B.C., tree-ring calibrated to 4,800-5,400 B.C.) The early cultivated cereals were probably unsuited to upland conditions, and economy in the valley communities continued to be mainly based on modified hunting and gathering strategies.

A certain human presence near the core of the Alps develops with the onset and the spread of the Square-Mouthed Pottery (SMP) culture, which was probably parallel to Fiorano at least in its initial stage. An oval hut of the early phase of this culture, 7 x 4 meters in diameter, is reported from Garniga near the summit of Mt. Bondone, which overlooks the town of Trento (Bagolini and Perini 1973). But the push into the mountains appears to have really developed only in the second of Barfield's three phases of the SMP culture, as they were first distinguished in the Veneto and Emilia settlements (Barfield and Broglio 1971, Broglio 1972a). L. H. Barfield (1971:45–46) says,

> The choice of naturally fortified hill-tops, strategically dominating river routes, . . . marks a divergence from the types of settlement location listed for the Finale-Quinzano phase, and it may reflect the increasing importance of trade routes or an unstable political climate.

(A shift in population pressure and a search for new breeding procedures may perhaps provide an alternative explanation, for example, an assay of transhumance methods.)

In the Adige Valley, some shoe-last adzes found at La Vela and in other Late Neolithic contexts are akin to the Hinkelstein and Flomborn types of the *Bandkeramik* and Aichbühl Cultures of Central Europe. They are thus considered the earliest sure evidence for direct communication through the Brenner or the Resia Pass (Barfield 1970). There is indeed a growing body of evidence showing that in a period between the Late Neolithic and the Bronze Age the Upper Adige Basin was closely linked to developments in the *Nordalpiner Kreis, sensu* Driehaus (Pfyn, Altheim, Baalberg, Ievišovice B; see Perini 1973). About this time, stone cist burials appear as a regular funerary style throughout the Trento area and far afield in some of the Adige Basin branches up to Bolzano (Barfield 1970; Broglio 1970). This funerary manifestation seems to have lasted till the Early Bronze Age (Fasani 1965; Barfield 1970). Despite some statements to the contrary, one may still raise the question as to whether or not these cist burials are related to the "Neolithic" cist

cemeteries long known in the Aosta Valley (Piedmont), another major valley of the Alps.

The cemeteries in the Upper Aosta Valley are characterized by crouched, often multiple inhumations in cists of stone slabs. Their usual locations are on escarped spurs hanging high above the *thalweg* (e.g. Montjovet, Vollein). They are very poorly furnished, or at any rate material useful for dating has not yet been reported. But undoubtedly a rather close correspondence exists there with the parallel series of cemeteries carefully explored in the upper Rhône Valley, Canton Wallis (Dellenbach 1935; Sauter 1950, 1955a, 1955b, 1963, 1969; Barocelli 1951, 1956, 1962b; Sauter and Gallay 1969). These Swiss sites are admittedly connected to Cortaillod-influenced, Chassey local groups, usually thought of as Swiss "Middle" (actually "Early," as far as Wallis is concerned) Neolithic. Accordingly, Aosta Valley graves are referred to as the Italian counterpart of that culture complex, the "Upper Neolithic" Lagozza Culture (Radmilli 1963).

On the basis of recent chronometric datings (Thomas 1965; Broglio 1972a) and of revisions in interpretation, I wonder whether the chronological overlap among Swiss Chassey-Cortaillod, Italian Logozza, and the SMP culture middle phase may not be much wider than supposed (Fedele 1973c, i.p.b.). One square-mouthed vessel sherd was found right in the type settlement of the Swiss group referred to (St. Léonard I) (Sauter 1969, 1970).

Generally speaking, the Neolithic cist grave subcultures in the Alps are more likely to form part of a larger complex whose distribution is significantly concordant with the broad boundaries of Pyrenean–Alpine relief (Sauter 1955b; Ripoll Perelló and Llongueras Campañá 1963; Guilaine and Muñoz 1964). They might be looked at as a mountain-specific, or a mountain-born, phenomenon (Fedele, i.p.b.).

The appearance of the SMP culture in the mountain area may be well observed in the Piedmont Alps. Some old and poorly studied sites are of little interpretive utility: Vayes "Shelter" in the lower Susa Valley (Piolti 1902; Taramelli 1903; cf. Fedele 1971b, 1973c; Brown 1965) or Viù-Versino (Barocelli 1962a). But Aisone Cave, St. Pierre near Aosta, and Monfenera provide substantive indications of the event.

A child burial in the Aisone Cave, in Cuneo province (Rittatore Vonwiller 1951, 1952a, 1952b, and personal communication 1971; Radmilli 1962), has been radiocarbon dated 3,875±75 B.C. (R-95; tree-ring calibrated date after Renfrew's 1971 chart: *c.* 4,800 B.C.); but the relevance of this occupation site to the early phase of the culture (Barfield and Broglio 1971; Broglio 1972a) cannot be definitely ascertained. St. Pierre is a hill a few kilometers upstream from Aosta; it conceals a multi-component settlement which preliminary recoveries of scattered materials suggest is important (Mollo 1972; Mollo and Mezzena, per-

sonal communication 1972). A sherd from a square-mouthed vase and a square polished ax may show the first evidence of the actual presence of this culture on the Italian side of the Great St. Bernard Pass. On the Swiss side again, "Middle" Neolithic remains have been recognized at Sembrancher (Dellenbach 1938; Sauter 1971: 262; 1972).

The latest excavations on Monfenera have produced evidence that a dwelling structure was built by SMP members right inside the Belvedere Shelter, partitioning the receding cave where the rock roof ends with a sort of post wall. Several post-holes of light inner substructures and two hearths have been found. Neolithic remains from this site are quite consistent with the peculiar association of the Chiozza–Rivoli Spiazzo phase in the East (Fedele 1973a, 1973c). Here, too, an extraordinarily dominating location is linked to this phase of the culture. Some traces of a rock-crystal industry may allow a comparison with the Vollein cemetery in the Aosta area (Daudry 1969:222–225; Mollo, personal communication) and St. Léonard in Wallis (Sauter 1959). Though disturbed and fragmentary, the Belvedere evidence justifies the inference that this site has a bearing on the problem of the diffusion and adaptations of the SMP culture to mountain biotopes (Fedele i.p.b.). Further field research there should add new data.

According to reliable radiocarbon datings, the chronology of the three main phases of the SMP culture is, respectively, Finale-Quinzano, *c.* 4,100–3,400 B.C.; Chiozza–Rivoli Spiazzo, 3,500-3,100 B.C.; Rivoli Rocca–Castelnuovo, undated. The tree-ring calibrated chronology (Renfrew 1970, 1971) would be *c.* 5,000–4,300 B.C. and 4,400–?4,200/?3,900 B.C.

From a middle–late phase of the Neolithic onward, the presence and activity of human communities appear to have been quite intensive in the Western Alps. A number of surface finds — mainly greenstone polished axes — come from high valleys and slopes still crossed by cattle-tracks — Cuneo, Turin, and Aosta Valleys (Barocelli 1933, 1962b, 1968; Blanchard 1952). A test excavation intentionally looking for a prehistoric occupation in a cave at 1,525 meters elevation near the sources of the Po failed to substantiate this assumption (Richard 1932; Barocelli 1933:12-3), as did our own recent exploration of a cave 2,110 meters high in the Varaita Valley (Fedele, unpublished). Another interesting attempt was made in the area of the famous Mt. Bego rock engravings at Gias del Ciari Shelter, 2,150 meters above sea level. The lower cultural horizon yielded a few materials ascribed to Lagozza (Louis and Segui 1951; Louis and Isetti 1964).

All these cultural ascriptions must be considered quite controversial, as they commonly disregard any explanation in Alps-oriented, rather than plain-oriented, terms. At best they probably prove an autonomous activity in a general time-span from the Neolithic to the permeation of Alpine

routes by bronze-bearing groups. Gias del Ciari, and perhaps the poorly-excavated Grai Cave in the southern part of Piedmont (Novelli 1968), should also be viewed as reflecting a well-established transhumance economy.

The Metal Stage

Radiocarbon-dated Lagozza sites span the first half of the third millennium, tree-ring calibrated to the first half of the fourth (Renfrew 1970). The Copper Age thus appears to have been introduced as early as the mid-third, or the fourth, millennium B.C.

Many authorities now agree that the first important outburst of so-called rock art in the entire Alpine territory goes back to the early Copper Age of the surrounding lowlands (Anati 1964, 1966, 1972; Barfield 1971; Fedele, in press b). In recent years, outstanding discoveries have occurred at Sion in Switzerland and at St. Martin-de-Corléans, an Aosta suburb. They have revealed monumental centers composed of cist burials, dolmen tombs on podia, decorated "statue-menhirs," and engraved anthropomorphic stelae. Standing "statue-menhirs," that appear to belong to a little-known Late Neolithic/Copper Age culture, were later pulled down and subsequently re-used as walling slabs in Bell Beaker graves at Sion (Bocksberger 1966, 1968a, 1968b; Sauter 1972; A. Gallay, unpublished), or in Early Bronze cist graves at St. Martin, according to a Polada-like elbow-handled cup found in one of them (Mollo 1972).

These discoveries can ultimately relate to each other all the different rock art manifestations previously known within and around the Alps, showing that they are aspects of a single cultural whole. (Santacroce 1969 provides a bibliography on the Alpine rock art.) Moreover, the new finds throw light on cultural events and chronological relationships within the troubled period of the circum-Alpine Copper Age.

Leaving out details, the resulting picture seems that of a relatively long-lasting Copper Age (*c.* 2,500–1,800 B.C., Barfield 1971; around the third millennium, Renfrew 1970), during which the Alpine chain was situated at a crucial crossroads of several European interests, influences, and routes of migration or raiding (Bocksberger 1964, 1968b, 1969; Brown 1965; Barfield 1971:63; Fedele 1973d). In this context one might examine the problem of the persistence of self-contained mountain communities in these times and their interactions with foreign elements.

Copper Age cultural groups of the Po Plain only occasionally attained the Pre-Alps, as for example the Collective Cave Burial group at Buco della Sabbia (Lombardy).

In subsequent periods the amount and quality of evidence about man in

the mountains speedily increases. Information is especially rich for the Eastern Alps and the Adige surroundings. Ledro Lake and Fiavè Peat-bog have large settlements, and many upland localities in the Bressanone valleys may be mentioned in this context.

A major shift in frequency is apparent when one considers the Final Bronze and the Early Iron ages. This change may be related to the general break in cultural continuities between the Late and Final Bronze Age that is perceivable in the archeological record south of the Alps. Beyond the watershed, a corresponding maximum population recorded, for example, in Savoy is specifically dated to the Final Bronze Age (Combier 1962).

Evidence of visits, transits, and stays even at considerable altitudes become numerous (Gias del Ciari; Little and Great St. Bernard passes; Mt. Sciliar/Schlern; Malciaussià Lake at the head of the Viù Valley; St. Barthélemy in the Aosta Valley, etc.) and scattered finds of bronze tools, weapons, or hoards of this period are almost commonplace. Prolonged occupation is proved by mountain villages and "hill-forts" (commonly called *castellieri* or *castellari*) and by cemeteries with different burial types: cremation and urn; extended with metal grave-goods; or cairns, as in the Cuneo valleys. The French counterpart of this evidence is noteworthily abundant (cf. Courtois 1957, 1961, 1968; Bellet 1965; Bodard 1967; Bocquet 1969; Fedele, in press b).

Some sites might be interpreted as summer camps related to transhumance, but specific research to test this hypothesis is still to be done. One hundred hill-top centers have been recorded in the Cuneo valleys, in the Aosta Valley up to 2,400 meters (Mollo 1972), in the Lombard and Venetian Pre-Alps, and throughout the Adige Basin. A small "eagle's-aerie" cave on Monfenera seems to have been occupied in this period (Fedele 1972b). Where thorough excavations have been undertaken, many regularities in house construction and associated evidence appear to link the Iron Age communities to the cultural inheritance surviving in the Alpine territory today.

A possible Atestine outpost, established by 800 B.C. at Rivoli Veronese to secure the border against the Raeti mountaineers, pre-figured in the Iron Age what would later be common under the Romans. It points to the existence of distinct, strong sociocultural systems in the inner Alps. As a rule, Celtic movements and harsh Roman intervention did not very much alter the basic protohistoric culture complex established in the Alpine range (cf. Rittatore Vonwiller 1972). Classical sources reflect a respectful attitude toward the national identity of the mountaineers and their expertise of control over the high routes (see Allais 1890 and Gribaudi 1928, as well as Finocchi 1960, Prieur 1968, Agavit 1970). Quite probably at the same time the reduction of the Alpine region into a conservative enclave also set in.

MAN–MOUNTAIN RELATIONSHIPS IN ANTHROPOLOGICAL PERSPECTIVE: SOME CONCLUSIONS

1. Despite specific bio-repulsive factors, man has been present in mountain regions widely and persistently. No other hominoid, and almost no other primate species, displays this capacity to such an extent.

The present theme may be viewed as only a chapter in a more comprehensive problem — that of the conquest by man of "difficult" environments. Such environments are represented for instance by higher latitudes in both hemispheres and by mountainous territories (some deserts and the tropical rain forest might of course be added). By difficult environment is meant any combination of states of environmental subsystems under which individual survival and/or the homeostasis of the human ecosystem is put in danger.

Even if a partial mastery of difficult habitats was reached much later in human evolution, the evidence secured in the Alps concurs to show that success was initiated by groups at the Middle (or Lower?) Paleolithic technological socio-cultural level. High altitude sites, or sites very near to Pleistocene glaciated areas, are useful in providing information on this topic (e.g., Méroc 1953; Wendorf and Miller 1959; Lyubin and Kolbutov 1961; Lyubin 1971; MacDonald 1968; Ravskii and Tseitlin 1968; Bader 1968, 1971a, 1971b; Kanivec 1969; Bryan 1969; Jelínek 1969: 477). This argument has been recently raised with some original approaches (Watanabe 1969; Collins 1969; G. Clark 1970:72ff.; Butzer 1972).

Current ecological research on living human ecosystems which function while coping with more or less extreme environments (e.g., Burton and Edholm 1955; Dunbar 1968; Roberts 1970; Clegg, Harrison and Baker 1970; Freeman 1971) has a potential bearing on the explanation of the record from the past. As a result of continued environmental stresses and severe demands, plasticity and adaptive responses are elicited and high, selective pressures are generally established. The nature and specificity of human responses, as well as the inherent processes of selection and evolution, both somatic (Billy 1966; Ferembach 1967; Vallois 1968; Etingen, Nikityuk and Belkin 1969) and cultural, are the object of the above investigations.

Unfortunately, we are still unable to detect the same phenomena in the archeological record (see Watanabe 1969 for an insightful discussion; cf. Fedele 1966b, 1973b, and in press b). The actual source of man's interest in mountainous lands is not always understood in depth.

2. The evidence of "mountain" Paleolithic from the Italian Alps may be evaluated in the light of the wider comparisons mentioned. It seems likely that the Sesia Valley was extensively occupied by its glacier when the outstanding rampart of Monfenera was being visited by some Mous-

terian and many Upper Paleolithic hunters. Periglacial frost phenomena, such as cryoturbation or cryoclastic collapses of the vault, mark the climaxes of this period at the Belvedere Shelter, which faces towards the Sesian corridor. These archeological data reveal an incipient Paleolithic intrusion into, if not an occasional living in, the northwestern Alps by Mousterians; the same seems to be true for the rest of the chain.

Perplexing manifestations have often been observed in the Alpine and circum-Alpine area in connection with Mousterian assemblages. The name, "Alpine Mousterian," was proposed to single out this geographical complex of doubtful finds as a culture, according to Emil Bächler in Switzerland and Raffaello Battaglia in Italy (cf. Combier 1956; Müller-Karpe 1966). But now this theory is being disproved. The assemblages found at many sites along the Alps show structural divergences that prevent us from envisioning a homogeneous, separate whole. "Alpine" Mousterian sites appear commonly associated with cave bear deposits, but now the problems peculiar to the behavior of cave bears in caves have been cleared up enough to warn against old misunderstandings (Spahni 1954; Leroi-Gourhan 1964; Andrist, Flükiger and Andrist 1964; Lequatre 1966; Fedele 1966b, 1974b; Egloff 1971). Artifactual processes such as microlithic trends or expanding denticulation may well reflect adaptations to the mountain environment of the Würm Glaciation — a raw material economy, for instance. Alpine Mousterian is probably not a distinct culture (Bordes 1968), but the result of an "adaptive" convergence depending upon common demands of the contemporary Alpine environment (Fedele 1973b, 1973c).

3. If we turn now to Upper Paleolithic groups, it is important to emphasize the probable evidence of artificial sheltering at a site on the Asiago Plateau. One might wonder whether this is an indication of actual overwintering, but the question cannot be answered as far as that site is concerned.

As is well known, the building of huts or tents by Oriental Gravettian and other Upper Paleolithic groups has a long tradition in eastern European plains. These cultures mastered fairly well the adverse environments of their territory, whether it was the mountains above 1,500 meters, as is testified by the Mladeć point industries of Poland (cf. Broglio 1968), or the *Inlandsis* borders up to about 66° North on the middle Pečora River, at Byzovaia (Bader 1971a).

A great increase in human presence and activity appears peculiar to the last phases of retreat of the Würm Glaciation and to the Anathermal. Extreme Epigravettians and — after a gap in the present record — active Epipaleolithic hunter–gatherers, seem to have attained notable population densities in certain privileged, moderate altitude zones, from there raiding far upward.

Human skeletal remains have occasionally been found in association with the Paleolithic and Epipaleolithic assemblages mentioned above, but they are too meagre to allow reliable ascriptions. Mousterian-associated remains studied so far would have Neanderthal characters (Mezzena Shelter near Verona: Corrain 1968). The Buco del Corno finds and the remarkable Vatte di Zambana Sauveterrian burial are unpublished.

4. Although the idea of an "Alpine" Paleolithic has been dismissed, an "Alpine" Neolithic might still perhaps be conjectured. The traces of the SMP culture now coming from the Piedmont region and from Switzerland could be hastily viewed as the first evidence of the use of a western pass (Great St. Bernard). But simple transit is not a satisfactory explanation. There may be early evidence of a permanent settlement in the major intermontane valleys. The basic problems affecting the first encounters by agriculturists and breeders with the Alps were resolved. A combination of valley-floor cultivation and incipient mountain stock-rearing might be presumed to be in existence at this time or shortly later (cf. Higham 1967; Phillips 1971, 1972). Environmental changes which accompanied the gradual shift from an Atlantic to a sub-Boreal climate (Frenzel 1966) must also be considered.

From a general standpoint, explanations in terms of *permanent settlements* in the Alps can be opposed to the traditional concepts in which stress was laid on use of passes for transit alone. Transit across passes may eventually prove to be subordinate, at least when viewed in our modern sense. In the Piedmontese–Swiss tract and in the Adige Valley–Tyrolese region as well, a unique complex of socio-cultural systems spanning either side of the ridge, connected by internal networks pivoting upon the passes, may provide an alternative model based on the Late Neolithic record. As research on living Alpine communities shows, watersheds unite, while often rivers and valleys divide (Fedele i.p.b.; Lasker et al. 1972).

Mountain groups had relations with the lowland cultural groups mainly in the larger valleys. The clearly exotic elements (traders, warriors, Childe's "prospectors"?) who criss-crossed the Alps in the eventful Copper Age touched the mountain communities but probably involved them only slightly. A substantial part of the populations of the mountains may have pursued the traditional, "Neolithic" way of life well into the second millennium, in an increasing integration within their own ecosystems. These mountaineers may even have played central, not peripheral roles, in the economic context of the time (for example in connection with the mining of metal ores, in the Central and perhaps in the Piedmontese Alps). But this is still difficult to verify (cf. Perini 1971a).

As previously stated, the next important phase of occupation in the

Alps seems to coincide with the Final Bronze and Iron Ages. An effectual control over the environment, within the limits of the carrying capacities of the exploited biotopes, was attained. No conclusive break with tradition is really perceivable in the subsequent history of many of these mountain settlers — until yesterday. Monfenera among other sites makes this emerging picture of strong continuities from protohistory to the Mediaeval and modern periods particularly impressive (Fedele, in press a).

Populations in the Western Alps, and perhaps elsewhere in the chain and in the Pyrenees, thus appear to have a 3,000-year history of relative biological segregation and cultural independence (Arbos 1922; Burns 1963; Matley 1968; Morton and Hussels 1970). Approximately 150 generations lived without interruption in this environment, this continuity leading them to achieve a high degree of integration with their mountain setting. Today a definitive disintegration has perhaps begun.

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The Epipaleolithic Men of Moita do Sebastião, Portugal

DENISE FEREMBACH

PALEOANTHROPOLOGY AND STATISTICS

The Moita do Sebastião settlement is situated around eighty kilometers northeast of Lisbon, on the shores of the Muge River four kilometers from its junction with the Tage River. The Epipaleolithic settlement, dated from 7,350 B.C. (plus or minus 350 years) was excavated by Ribeiro (in 1863 and 1880), dePaula and Oliveira (in 1884 and 1885), and Roche and da Veiga Ferreira (from 1952 to 1954). Many human remains have been discovered.

I examined 136 skeletons in different states of preservation: the remains of forty men, thirty-four women, twenty-two adults whose fragmentary remains preclude the determination of their sex, six adolescents, and thirty-four children. In this study, I will discuss only those crania which were complete enough to permit a racial diagnosis. These came from eighteen men and ten women.

It is a present-day tendency to rely only on numerical data and to leave to the computer the problem of drawing conclusions ignoring most of the nonquantifiable morphological features. Is such a procedure scientifically viable in paleoanthropology? Is it not too easy an answer to allow the machine so much initiative? Can it not produce hasty interpretations which are incomplete or even erroneous? This is what I wanted to verify from the study of these Portuguese fossils centering on the definition of

I was able to study the material discussed here thanks to the understanding of Pr. Mendes Correa and Pr. Santos Junior, as well as Mr. de Castel Branco and Mr. Moitinho de Almeida, directors of the Geological Service of Portugal in Lisbon, where part of the material is stored. Nor could I have accomplished this work without the friendly concurrence of J. Roche and O. da Veiga Ferreira. I would also like to thank Roland A. Champagne for his translation.

one or many racial types in this series. The comparison with other populations of this period will be the subject of a later study.

Four statistical methods were used: equiprobable ellipses, the graphic profile (reduced deviation), discriminating functions, and the factorial analysis of principal components.

EQUIPROBABLE ELLIPSES

Although this technique has existed since 1885, it was not considered by anthropologists until about 1950. At that time Defrise-Gusenhoven (1955, 1961) made certain aspects of it more precise. Following this writer, I traced the ellipses corresponding to the "rates of remoteness" from the central points of 70 percent, 95 percent, and 99 percent. By convention, a rate included between the ninety-fifth and ninety-ninth percentiles corresponds to a significant difference, the probability obviously being greater as the percentage increases. Below 95 percent, the specimen, the mean of the series, being compared admittedly does not differ by a significant amount from the series taken as the standard of comparison.

I have retained, a pair of characters, those in which subjects seem to isolate themselves on the histograms: (1) the length and maximum width of the cranium, shown in Figure 1; (2) the height–length index and the height–width index, shown in Figure 2; and (3) the fronto-parietal index and the fronto-sagittal index, shown in Figure 3. Unfortunately, it was not possible to take into account the measurements of the face, because of the small number of specimens on which they could be taken; this is even more regrettable in that, as we will see later on, these are the measurements which, due to their descriptive traits, have been most controversial in differentiating present racial samples.

The examination of Figures 1, 2, and 3 reveals that, in our case, the equiprobable ellipses do not permit the isolation of individuals.

DISCRIMINANT FUNCTIONS

Relative to the study of ancient crania in the Canaries, Knussmann (Schwidetzky 1963; Schwidetzky and Knussmann 1963) calculated a discriminant function which permits the distinction of male Cro-Magnoid crania from Mediterranean crania. This function retains only six features, four indices and two descriptive features. His formula is as follows:

$$D(x) = -1.01\,x1+0.36\,x2+2.09\,x3-0.19\,x4-6.31\,x5-12.01\,x6,$$

in which $x1$ is the horizontal cranial index; $x2$ is the upper facial index; $x3$

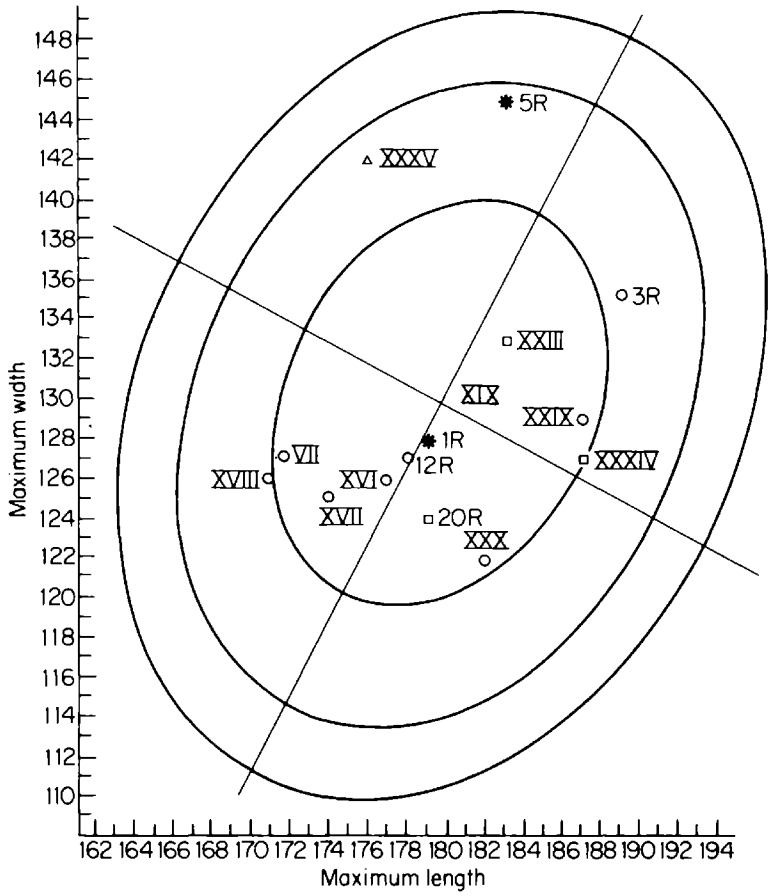

Figure 1. Correlation between maximum length and maximum width: equiprobable ellipses, the outer at 99 percent, the middle at 95 percent, and the inner at 70 percent. ○ = Mediterranean, * = Cro-Magnoid, □ = C-M/M crossbreed, △ = Alpine

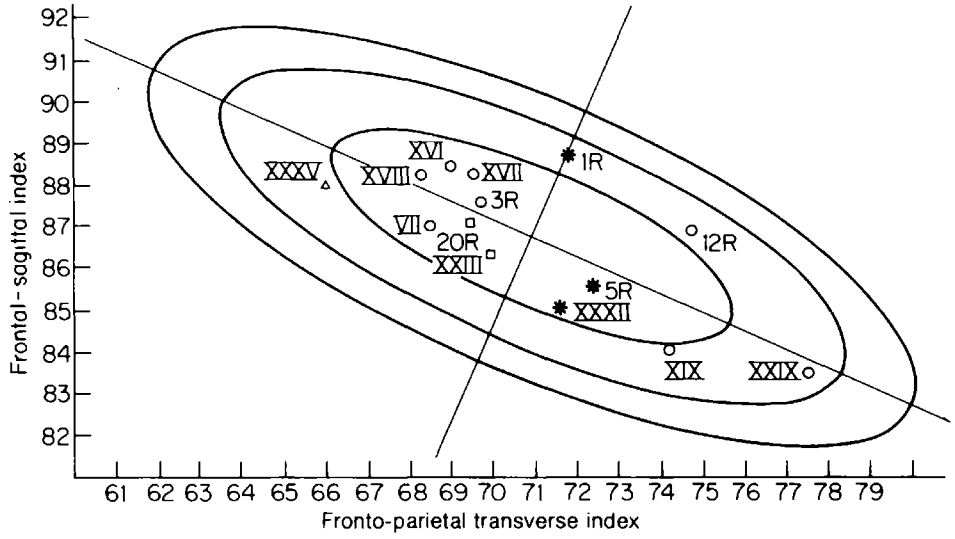

Figure 2. Correlation between height–width index and height–length index: equiprobable ellipses at 99 percent, 95 percent, and 70 percent. ○ = Mediterranean, * = Cro-Magnoid, □= C-M/M crossbreed, △= Alpine

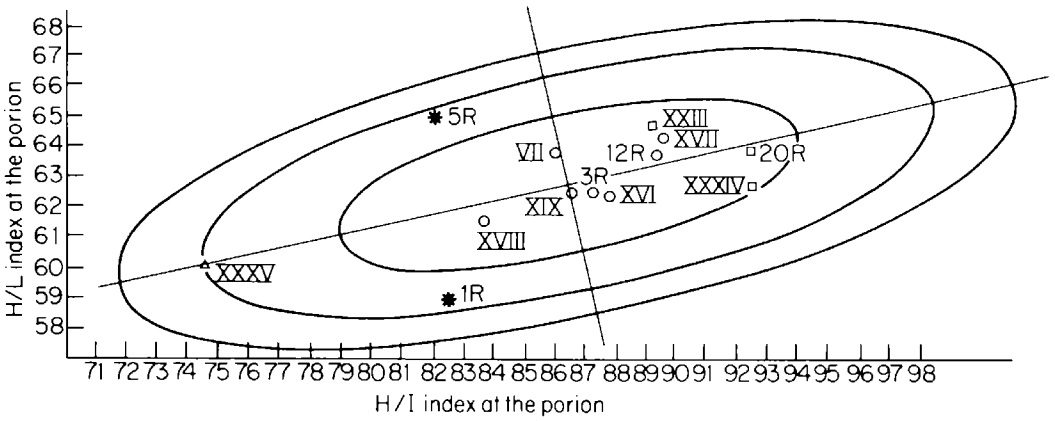

Figure 3. Correlation between fronto-parietal index and fronto-sagittal index: equiprobable ellipses at 99 percent, 95 percent, and 70 percent. ○ = Mediterranean, * = Cro-Magnoid, □ = C-M/M crossbreed, △ = Alpine

is the orbital index; $x4$ is the nasal index; $x5$ is the development of the glabella; and $x6$ is the projection of the malar (1 = receding; 2 = average; and 3 = projecting).

A preliminary remark must be made. This discriminating function, like the one to be given later, has been calculated to be applied to Cro-Magnoid and Mediterranean crania. It can be of no help in differentiating other racial samples within a series. In fact, a discriminating function cannot be conceived without a preliminary typological analysis.

It must also be emphasized that these equations are generally applicable only for the series belonging to the same general population from which the samples were taken to establish the function.

Concerning the series of Moita do Sebastião, I have verified that this function, as well as the one given later, gave some results which were relatively harmonious with those of classic typological analysis; therefore, I thought that, despite everything, it was possible to account for the conclusions realized by their implementation.

Finally, a third objection may be brought forth. This function, because it was established from data collected about male crania, should not, in principle, be used except for specimens of this sex. But we know that there is no appreciable difference in sex among the indices; these reflect four out of six features. Regarding the other two features, while the influence of sex probably does not intervene in the projection of the malar, this influence is not negligible, by contrast, in the development of the glabella; yet the least projection of this feature is manifested, in a relative manner, in all the female crania, whether they are proto-Mediterranean or Cro-Magnoids. Therefore, the comparison by sex is justified.

In applying the equation to the Canary Island crania, Knussmann

determined the "pole of the Mediterranean sample" to be 67.79 and that of the Cro-Magnoid sample to be 35.51. The limit between the two has not been specified.

A second function, including eleven features, has been established, again by Knussmann (Roth-Lutra 1967) with the same goal. But the basic series were Neolithic Ukranians for the Cro-Magnoids and crania of the Iberian Peninsula for the Mediterraneans. His formula is as follows:

$D11 = 14.97\ x1 + 1.77\ x2 + 20.88\ x3 - 2.49\ x4 + 0.82\ x5 - 2.12\ x6 - 2.52\ x7 + 2.39\ x8 + 18.90\ x9 + 20.75\ x10 - 20.95\ x11,$

in which $x1$ is the horizontal cranial index; $x2$ is the height–width index at basion; $x3$ is the transverse cranio-facial index; $x4$ is the upper facial index; $x5$ is the nasal index; $x6$ is the orbital index; $x7$ is the jugo-frontal index; $x8$ is the fronto-parietal index; $x9$ is the vertical cranio-facial index; $x10$ is the module of the cerebral cranium; and $x11$ is the module of the facial cranium (mean of the sum of the bizygomatic width and the upper facial height).

We have previously seen that this function had been calculated from masculine crania. We have also seen that a sex distinction could not be maintained for the indices; these correspond to nine out of eleven features. The two others are modules; their least value, once averaged independently of race among the female subjects in comparison with the male subjects, seems to me to make a comparison according to sex plausible.

The mean obtained for the Neolithic Cro-Magnoid Ukranian crania was determined to be 516.1, with the extreme values from 504 to 525. For the Iberian Mediterranean series, the mean was 497.2 with the minimum 480 and the maximum 513. According to Roth-Lutra, from x to 506, we have "leptodolichomorphs" (Mediterraneans) and from 510 to x, we have "eurydolichomorphs" (Cro-Magnoids). Between 507 and 509, one finds an undetermined middle zone.

Table 1 shows that the two equations agree with the typological analysis to classify the crania 3R and XVI and the female crania 12R, VII, and XVIII near the Mediterranean pole; the masculine cranium 5R is introduced as being very Cro-Magnoid; the female specimen 1R and the male specimen 20R are closer to the Cro-Magnoid pole for the first equation, very close to the overlapping zone for the second (1R), and, in any case, a little higher than the noted minimum (504) of the Cro-Magnoids or close to the upper limit of the PM (20R). The cranium 1R would therefore be additionally allied to the Cro-Magnoids, while the cranium 20R is presented rather as a crossbred form.

Specimen XXXV, which is typologically Alpine, is sensibly placed halfway in the first equation; in the second equation, it is in the Mediterranean zone, but near the upper limit.

The discriminating functions are therefore retrieved from an interest-

Table 1. A synthesis of the racial diagnoses

	Classically	Discriminating function C-M/M				Reduced intervals	Factorial analysis	Conclusion
		six factors		eleven factors				
Males								
T	PM	–	–	–	–	–	–	PM
Y	PM	–	–	–	–	–	–	PM
W	CM	–	–	–	–	–	–	CM
Z	PM	–	–	–	–	–	–	PM
3R	PM	74.81[a]	M	493.03	M	–		PM
		84.84	–	492.01	–		–	
5R	CM	3.02	CM	517.1	CM	–	CM	CM
		9.7		516.5				
9R	PM-CM		–	–	–	–	–	PM-CM
15R	PM	–	–	–	–	–	–	PM
20R	PM-CM	40.83	CM-PM	502.5	PM	–	–	PM-CM
		48.57		501.8				(nearer CM)
30R	PM-CM	–	–	–	–	–	–	PM-CM
XVI	PM	60.89	M	498.3	M	–	–	PM
		62.30		498.1				
XX	PM?	–	–	–	–	–	–	PM?
XXII	–	–	–	–	–	–	–	CM
XXVII	PM	–	–	–	–	–	–	PM
XXVIII	PM	–	–	–	–	–	–	PM
XXXII	CM?	–	–	–	–	–	–	CM?
XXXIV	PM-CM	–	–	–	–	–	–	PM-CM
XXXV	A	52.67	–	500.2	–	A	–	A
				501.0				
XXXVII	–	–	–	–	–	–	–	–?
XLI	CM	–	–	–	–	–	–	–

Table 1 (*continued*).

Females								
1R	CM	41.77	CM	506 505.7	overlap zone	–	CM	CM
11R	?	–	–	–	–	–	–	?
12R	PM	62.73 68.38	M	496.9 496.3	M	–	–	PM
31R	–	–	–	–	–	–	–	?
32R	?	–	–	–	–	–	–	–
VII	PM	75.89 70.45	M	–	–	–	–	PM
XVII	PM	–	–	–	–	–	–	–
XVIII	PM	60.99	M	490.5	M	–	–	PM
XIX	PM	–	–	–	–	–	–	PM
XXIII	CM-PM	–	–	–	–	–	–	CM-PM
XXIX	PM	–	–	–	–	–	–	PM
XXX	PM	–	–	–	–	–	–	PM
XXXIX	PM	–	–	–	–	–	–	PM

Key: PM = proto-Mediterranean; CM = Cro-Magnoid; A = Alpine.

[a] When two quantities are given for a single cranium, the first indicates the value of the discriminating function calculated to account for the right orbital index, the second, for the left orbital index.

ing contribution; but it must be emphasized that without a preliminary typological analysis they could not have been implemented.

GRAPHIC PROFILE (REDUCED DEVIATION)

The same remark is pertinent to the graphic profile. This technique allows one to visualize on a graph the differences between the average values of the traits of two populations or even between the values of an individual and those of a population, the difference being expressed in units of sample intervals.

Through the typological study, it seemed to me that two crania, that of a child (XXIV) and that of an adult male (XXXV), manifested Alpine traits. I then made use of the graphic profile by taking as a reference the Savoyard series of crania studied by Billy (1962). Figures 4 and 5 demonstrate that no measurement or index of the cerebral cranium brings about

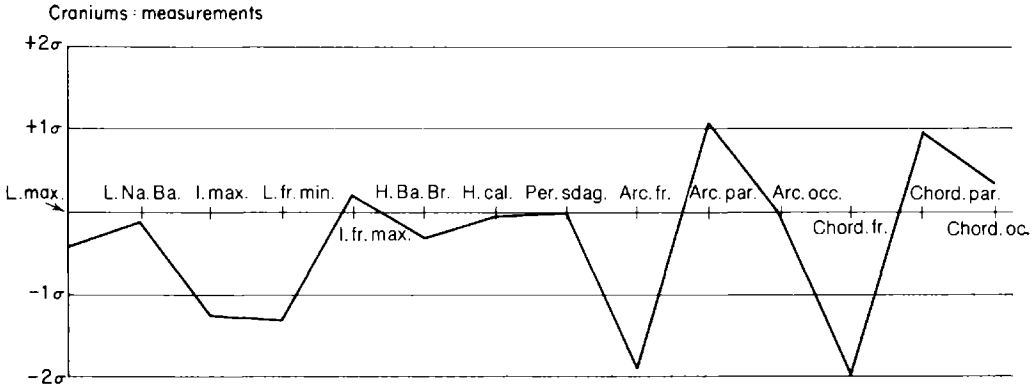

Figure 4. Comparison between the measurements of the Alpine cranium XXXV and those of the Savoyard crania studied by Billy (1962)

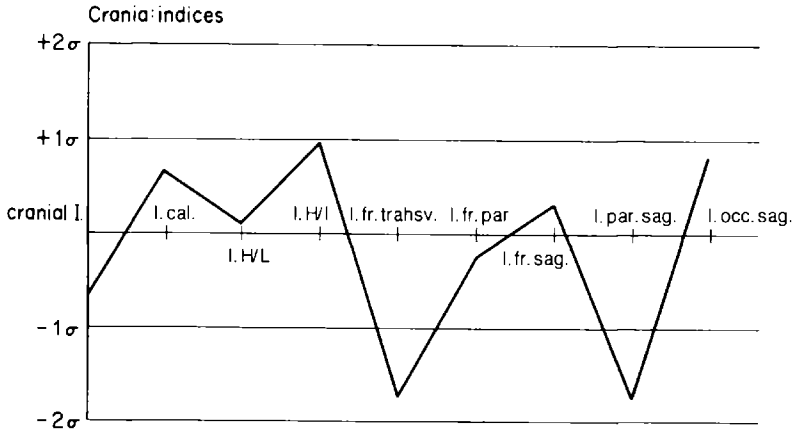

Figure 5. Comparison between the indices of the Alpine cranium XXXV and those of the Savoyard crania studied by Billy (1962)

a difference in the two standard deviations. The majority of the differences is even inferior to one standard deviation. Therefore, the fossilized cerebral cranium cannot be separated from that of the modern Alpines.

Regarding the less numerous measurements of the face (Figure 6), the width and height alone of the right orbit appear to be statistically inferior to the corresponding measurements taken from the contemporary fragments. This unique detail does not permit one to distinguish the fossil subject: it may be considered as the persistence of a primitive feature.

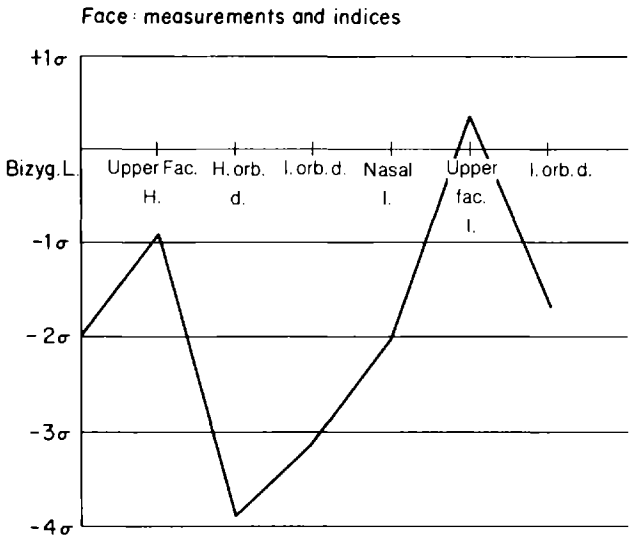

Figure 6. Comparison between the measurements and the indices of the face of Alpine cranium XXXV and those of the faces of the Savoyard crania studied by Billy (1962).

PRINCIPAL COMPONENT FACTOR ANALYSIS

A program of principal component factor analysis space has been refined at the Laboratoire Anthropologie de Genève by P. Moeschler, who proposed that I apply it to the crania of Moita do Sebastião.[1]

Let us remember that this type of analysis is performed when "one has statistical data which can be introduced only within a space of great dimension" and when "one wants to introduce, in view of the possible, these statistical data in a space of scanty dimensions, with the minimum loss of information" (Lebart and Fénelon 1971).

This test, which results in one or several histograms, allows one to specify the homogeneity or the nonhomogeneity of a series. Twenty-six

[1] I am especially indebted to him for this suggestion. I would also like to especially acknowledge R. Menk, who was responsible for adapting the program to small samples and implementing it.

features have been retained, of which eight are indices; the redundance among variables has been eliminated as much as possible.

For this analysis, we have added the values of five crania, all proto-Mediterraneans, which originated from a neighboring and contemporary settlement, Cabeço da Arruda.

The calculations were made at first by using the often-incomplete original data: matrices of correlation, standardized vectors, and adjusted vectors. Then, from these results, the missing data were reconstructed and the calculations performed again to finally establish histograms of the number of individuals according to their linear function.

INTERPRETATION OF THE RESULTS

The Male Crania

The first five factors have been retained. The first explains 44.8 percent of the variance, the second 29.5 percent, and the third 11.6 percent. The first three factors therefore explain 86 percent of the variance; hence, we could retain only them. With the fourth, and then the fifth factors, 95.5 percent of the variance is attained (Figure 7).

In the first factor, practically all the variables have a positive value, the negative values intervening only in a very slight percentage.

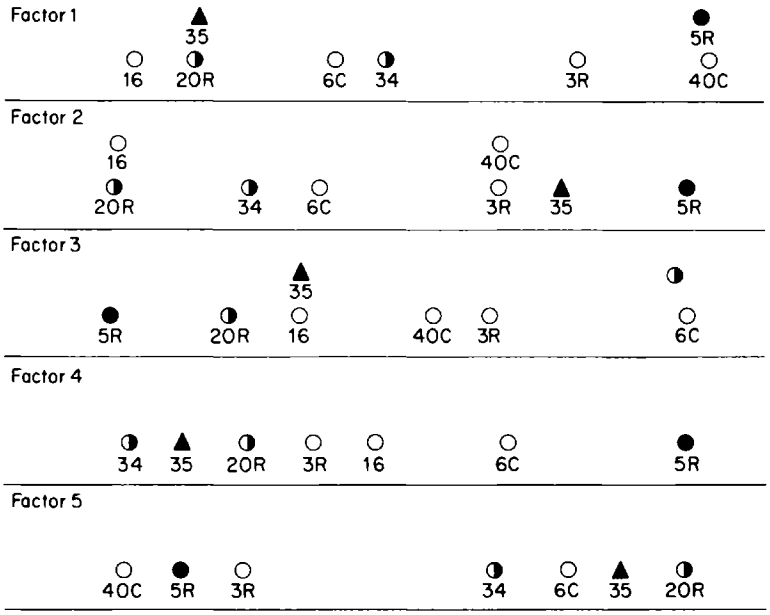

Figure 7. Histogram of male crania according to linear function, a conclusion of factorial analyses. Crania 6 and 40 belong to the Cabeço da Arruda series. ▲ = Alpine, ○ = proto-Mediterranean, ● = Cro-Magnoid, ◑ = Cro-Magnoid/proto-Mediterranean

The cranial capacity accounts for 51.93 percent of the factorial function calculated for centroids. This very high percentage disturbs the interpretation of this factor, since it determines it to a high degree. In decreasing order and very far back come the following features (which are limited to the first ten): antero–posterior diameter (5.85), frontal arch (5.07), porion–bregma length (4.97), projected porion–bregma height (4.36), frontal chord (4.32), biorbital width (3.82), parietal ligament (3.59), minimum frontal width (3.14), and fronto-parietal transverse index (2.42).

The excessive weight of the cranial capacity is probably responsible for the grouping of the histogram of the two crania showing the strongest values of this feature (5R and 40). Therefore, it is preferable not to take this factor into account in determining any conclusions.

With the second factor, the negative values become somewhat more important while the positive values remain more numerous. The cranial capacity (+65.8) dominates once again; but the difference with the second feature is that the transverse diameter of the head (+20.5) is less. Then, in decreasing order, come the following traits (which are limited to the first ten features): the maximum frontal width (+17.4), the parietal curvature (+15.4), the biauricular width (+14.9), the height–width index at the porion (−13.8), the horizontal cranial index (+11.3), the mixed index of the height at the porion (−10.8), the parietal-sagittal index (−8.9), and the length of the parietal chord (+8.3).

It is difficult to find a biological meaning for the fact that some features present a positive value while others present a negative value.

In the histogram corresponding to the second factor, the cranium 5R is isolated from the others on the right side of the graph. The classic study had it classified among the Cro-Magnoids. The Alpine XXXV sample is found to be closest to it. The cranium I considered to be crossbred (20R) is found, by contrast, on the opposite end.

The difference between the values of the first two features is less pronounced with the third factor, and these values are negative. This time, the antero–posterior diameter of the cranium is preponderate (−299.4), followed by the bizygomatic width (−275.2), and the parietal-sagittal index (+242.2); the cranial capacity intervenes only in the fourth position (−201.4); after that come the length of the parietal chord (+167.1), the fronto-sagittal index (+159.2), the height–width index at the porion (+144.8), the maxillo-alveolar length (+125.2), the biauricular length (+81.0), and the length of the frontal chord (+71.6).

In the histogram of the numbers of individuals according to their linear function, one finds the cranium 5R again isolated to the left; the cranium 20R is the closest to it, while the cranium XXXV is associated with the proto-Mediterranean cranium XVI.

With the factor 4, about which we shall not go into detail here, the

cranium 5R is again found apart from the other crania in the histogram. On the other hand, the crania 20R and XXXV are found at the other end.

The fifth factor represents only a very small amount of the total variance (4.0 percent). In the histogram, the cranium 5R is not individualized; the crania 20R and XXXV are found again grouped together, but on the right side of the graph.

Briefly, we can state that cranium 5R is located marginally on the histograms of factors 2, 3, and 4 (the only interesting factors, since the excessive weight of the cranial capacity disturbs the interpretation of factor 1, and the fifth factor represents only a slight proportion of the total variance [4 percent]), and that the crania 20R and XXXV are found close to or grouped with the factors 1, 3, 4, and 5, while both of them are close to 5R with the factor 3, XXXV being the only one with factor 2.

The principal result of this factorial analysis is therefore to isolate definitively the cranium 5R which, by other methods, had been defined as Cro-Magnoid.

The Female Crania

The first factor explains 39.1 percent of the variance, the second 18.1 percent, and the third 14.5 percent; the first three factors therefore explain 71.7 percent of the total variance. With the fourth (9.5 percent), we account for 81.2 percent; and with the fifth (6.7 percent), we have 87.9 percent of the variance and thus a little less than with the male crania (Figure 8).

The great majority of the features of the first factor are represented with a positive value. As with the males, the weight of the cranial capacity is especially strong (52 percent), which once again disrupts the interpretation of this factor. Then comes the antero–posterior diameter; it accounts for only 6.8 percent of the factorial function calculated for centroids. The following traits differ from the male ones or, if they are the same, appear in a different order: porion–bregma length (4.7), frontal arch (4.5), transverse diameter (4.4), maximum frontal width (4.4), parietal curvature (4.2), projected porion–bregma height (4.1), frontal chord (3.5), and parietal-sagittal index (−3.45).

In the histogram of the numbers of individuals according to their linear function, cranium XXIII, a crossbreed of proto-Mediterranean and Cro-Magnoid according to the typological study, which presents cranial capacity in the strongest series, is isolated at the right of the graph. On the other hand, cranium 1 is found mixed with the others.

With the second factor, the negative values assume some importance. The predominance of the cranial capacity disappears. The values of the vertical diameters and the corresponding indices, as well as the horizon-

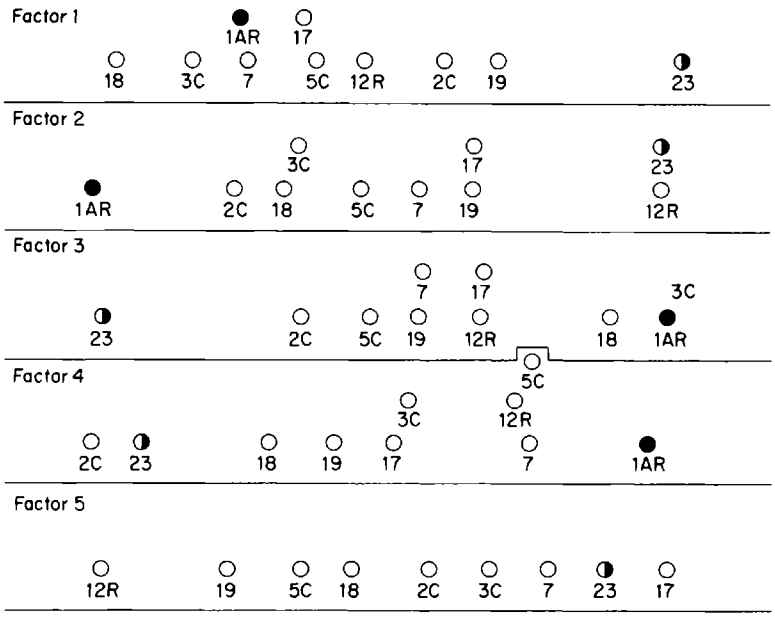

Figure 8. Histogram of female crania according to linear function, a conclusion of factorial analyses. Crania 2, 3, and 5 belong to the Cabeço da Arruda series. ○ = proto-Mediterranean, ● = Cro-Magnoid, ◑ = Cro-Magnoid/proto-Mediterranean

tal cranial index, are positive, while the values of the horizontal antero–posterior or transverse diameters and those of the curvatures or chords are negative. Therefore, there seems to be some opposition between these groups of features in the second factor which presents values that are well grouped. In decreasing order, we find the index of height–length at the porion (29.0), the index of height–width at the porion (24.2), the projection porion–bregma height (23.2), the antero–posterior diameter of the cranium (−22.3), the bizygomatic diameter (−21.7), the transverse diameter of the cranium (−20.2), the horizontal cranial index (20.2), the parietal curvature (−18.4), the porion–bregma length (17.7), and the parietal chord (−16.5).

In the frequency histogram, cranium 1R is isolated to the left; on the other hand, cranium XXIII is found at the far right with cranium 12R.

With factor 3, we find once again a preponderate value for the cranial capacity (+83.8), whose weight, as in the first case, interferes with the interpretation of this factor. In the histogram, cranium XXIII, which has the greatest cranial capacity, is thus found on the left, separated from the other specimens. One cannot observe any opposition between the measurements or the indices. We will simply point out the decreasing order of the first ten features: biorbital width (−21.9), bizygomatic width (−17.8), fronto-parietal transverse index (−17.7), minimum frontal width (−16.0), upper facial index (+12.9), fronto-sagittal index (−9.4),

parietal chord (+9.0), frontal arch (+8.7), and transverse diameter (+8.6).

Except for cranium XXIII, just singled out, the histogram does not distinguish any other sample.

The values are found once again to be grouped relatively for the fourth factor, for which the cranial capacity also comes first: cranial capacity (−15.320), parietal curvature (−11.624), parietal chord (−11.151), horizontal cranial index (−10.839), traverse diameter of the cranium (10.434), frontal chord (9.400), biauricular diameter (9.291), antero–posterior diameter of the cranium (8.683), bizygomatic width (7.863), and upper facial height (7.262).

Cranium 1R is isolated somewhat from the others at the right of the histogram; on the other hand, cranium XXIII is encountered at the left, between two proto-Mediterranean craniums.

We will say nothing about factor 5 since cranium 1 is not indicated in the histogram of the numbers of individuals according to their linear function.

In brief, it seems that the very significant contribution of cranial capacity in the factorial functions 1 and 3 calculated for the centroids interferes with the interpretation of the corresponding histograms. For the factors 2 and 4, there is a constant: the isolation of cranium 1R, which I had thought to be Cro-Magnoid with the help of other analyses. On the other hand, cranium XXIII, a crossbreed of Cro-Magnoid and proto-Mediterranean according to other analyses, is always found at the opposite side from cranium 1R. What is the cause of this? It is difficult to say.

Commentary

The application of this complex analysis, which demands a computer, to the Portuguese Mesolithic series is thus revealed to be somewhat deceptive. It seems to confirm the originality, with respect to the other crania, of the male sample 5R and the female sample 1R, which are classified, according to the typological study, as Cro-Magnoid. On the other hand, the crossbred forms are not at all differentiated by this method, any more than are the Alpine crania.

According to Menk (personal communication; see footnote 1), "the analysis of principal components allows one to formulate an initial typological hypothesis which can and must be tested by a discriminating analysis; and, in many cases, clear-cut improvements are obtained by this latter method."

We have just seen the results of applying discriminating functions.

The greater quantity of information revealed by these functions, whose results verify those of classic typological analysis, may be due to the

features which constitute these functions. Of twenty-six features retained for the factor analysis and eleven for the discriminant function, only three are finally common to both.

The numerical insufficiency of the sample, added to the fact that only a certain quantity of missing data has had to be completed, probably explains the precariousness of information obtained from the principal component factor analysis, a method whose interest, in other respects, is no longer to be proved.

In summation, in the study of this Portuguese series, the statistical tests gave the following results: the discriminant functions and the graphic profiles verified the racial affinities of some crania; the principal component factor analysis uniquely isolated the best samplings of two Cro-Magnoid crania; and the equiprobable ellipses gave us no information.

It is perfectly clear that this information does not constitute a judgment on the relative usefulness of these different tests; this is only a balance sheet on the present case.

Now let us consider what traditional study had revealed and which features permitted the initial differentiation of these crania.

DESCRIPTION OF THE CRANIA

The proto-Mediterranean crania have the following features: with a moderate capacity, the head appeared elongated, dolicho or hyperdolichocranial, high or moderately high compared to the length, high compared to the width (except for specimen XVIII, which is metriocranial). I also ascertained the presence of wormian bones in the lambdoidal suture in all the samples.

In overview, their form is ovoid. They have a moderately high forehead which is convex, moderately divergent, eurymetopic, most often noticeably vertical or slightly receding, sometimes presenting a sagittal streamlining, never pronounced. The frontal bumps jut out moderately or slightly. The eyebrow arches (*arcus superciliaris*), slightly or moderately developed in the females and most often moderate in the males, generally correspond to Cunningham and Schwalbe's "a" form, more rarely to form "b," which indicates the disappearance of the *margo supraorbitalis*. They are bounded, to the rear, by a moderately to slightly deep groove. The glabella does not surpass no. 3 of Martin's classification and most often resembles no. 2 on the male fragments; on the female fragments, the maximum development is found between numbers 2 and 3, and the depression above the glabella is slight or nonexistent.

The curvature of the parietal segment noticeably intervenes halfway along the sagittal length of the arch. The parietal bumps (*tuber parietale*) are most often obliterated. The flatness of the nuchal region is rarely

pronounced. A slight bun shape does not intervene with the regularity of the occipital curvature except on two female crania. The relative length of the three cranial arches is variable.

The upper temporal lines (*linea temporalis superior*) and also the lower temporal lines (*linea temporalis inferior*) generally form only a slight relief. The temporal bone (*os temporale*), which is small or moderately developed compared to the parietal, manifests a well-arched upper edge and a well-defined parietal incision (*incisura parietalis*). The mastoida protuberances (*processus mastoïdeus*) and the ridges above the mastoids, which are moderately or well developed on the males, appear to be slightly or moderately developed on the females. The nuchal region presents a low or moderate relief, never pronounced; on no cranium does the inion surpass no. 3 of Broca's classification on the males and no. 2 on the females.

In *norma posterior*, we observe the pentagonal form, houselike, as the parietals are united at a peak to form a very open or moderate keel. The depth and width of the glenoid cavity (*fossa mandibularis temporale*) are also moderate.

The face, leptene or mesene, portrays a narrow and high, or moderately high, with obliterated cheekbones and moderately developed malars. The cranio-facial traverse index indicates a crytozugous face. Some skulls have a slight or moderate alveolar prognathism; a total prognathism appears only rarely. In general, the faces are othognathous or otherwise very moderately projected forward.

The rectangular orbits (*orbita*), moderately separated with a main oblique axis, are classified as chamaeconch or mesoconch. The lower edge appears sometimes to be blunted, sometimes to be more or less sharp.

The nose (*nasus*), projected, concave, chamaerhinian or mesorhinian, begins in a slightly to moderately deep depression. The appearance of the lower edge of the pyriform opening is variable, with the height of the subnasal region being moderate or high. The jugum and canina fossa are found on all the samples. The palate (*palatum durum*), which is huge with a variable index, has a moderate to very pronounced depth. The dental arch draws an ellipse or a parabola. Finally, I observed the presence of a *torus alveolaris*, more or less developed on all the subjects.

The Cro-Magnoid crania are differentiated from the proto-Mediterranean crania by a relatively lower vault, especially compared to the width; by a further developed biporion diameter; by a more-accentuated projection of the external occipital ridge, of the glabella, and of the eyebrow arches; by the presence of a more-pronounced groove in back of these latter features; and, on some samples, as on the Alpine cranium, by a more-marked depth and width of the glenoid cavity.

Relative to the cerebral mass, the facial mass is further developed; it is

broad, but with a height relatively comparable to that of the proto-Mediterranean crania; because of this, the upper facial index does not differ from one sample to another. The largest facial width is characterized by the highest transverse-diameter values: bizygomatic width, biorbital width, and bijugular and maxillo-alveolar width. The maxillo-alveolar index corresponds to a more-pronounced brachyuric palate. The orbits appear, on the average, to be more depressed.

As with the cerebral cranium, certain features which cannot be measured also allow us to distinguish the face of a proto-Mediterranean from that of a Cro-Magnoid: the Cro-Magnoids have a nose root which is more sunken and more-developed malars. And their cheekbones project laterally while the canine fossa is less deep.

Thus, these are essentially the facial features and the descriptive traits which allow one to differentiate these two racial samples. In addition, the Cro-Magnoids of Moita do Sebastião appear to be smaller and more slender than the classic forms of the Upper Paleolithic of France.

Regarding the crania we have designated as Alpine, we find among them certain features which differentiate the Cro-Magnoids: height–width index corresponding to a relatively lower arch, presence of a more-pronounced groove in back of the eyebrow arches, development of the depth and width of the glenoid cavity, general form of the face, the orbits, and the development of the malars. The relief becomes more tenuous (eyebrow arches and glabella); but, all told, Alpine cranium XXXV reminds us even more of the Cro-Magnoids, of which it seems to be a gracilised variant with more-obliterated cheekbones.

CONCLUSIONS

The conclusions of this study are stated in Table 1. The last column gives the derivation of the crania, the results of the indications obtained from the different tests. To a certain number of samples, by reason of their defective state, only the "classic" test could be applied; yet they were accounted for by the verifications of the various tests used for other samples which resemble them.

But the principal conclusion which derives from the completion of this work is that one cannot (without risking the loss of a large quantity of information) dispense with traditional study utilizing both descriptive features and quantifiable features at the same time. Observation cannot be entirely replaced by measurements and the computer. Statistical tests are certainly very useful, but they serve on most occasions only to verify and to specify an argument.

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Sex Differences in the Frequency of Bone Fracture in Prehistoric and Historic Times

H. GRIMM

In 1969 Angelika Mohr presented, in her medical thesis, a catalogue of 647 cases, collected from the literature, of traces of bone fracture in human remains from prehistoric and historic times. Mohr's thesis included a listing of the location of the fractures on the skeletons, including left–right positioning, categorization by both time period and site, the healing processes and efforts at treatment which had been used, and the frequency of occurrence in males and females. Such a collection had not existed before that time. Medical–historical research had been content with citing isolated examples and with the discussion of causes, methods, and results of therapeutics. However, to characterize environment, economic and social structure in single groups of populations, and to investigate the question of whether or not the injuries caused by accidents or by aggressive acts influenced the microevolution of the hominids, it was necessary to make the largest possible number of known cases available to scholars. The number of samples which could be compiled by Mohr in 1969 has, in the meantime, been considerably increased. Aside from much disparate information, publications since 1969 by Angel (1970), Derums (1970), El Rakhawy et al. (1971), Morse (1969), Patte (1971), and Vyhnánek (1969) have especially contributed to this augmentation. These publications already contain lists or tables of classifications. Morse (1969), for example, quotes in table 1 87 cases of prehistoric fractures from Illinois alone. Our catalogue, which is now being prepared for the *Ethnographisch-Archäologisches Zeitschrift*, presently contains over 1,100 verified cases. Among those are 436 cases (nine of which are from the Neolithic) in which a sexual diagnosis is indicated. This enables new research to be done regarding possible differences in the frequency of fractures in males and females. Morse's table 1 gives a range of all traces of fracture on the skeletal remains of individu-

als, which have been defined as male or female, in nine prehistoric or historic periods ranging from the Paleolithic to the late Middle Ages. Evidence shows an increase in the frequency of fractures in males and a decrease in females. One would, however, from the point of view of bone composition alone, expect that the more fragile female skeleton would show more injuries, and that — apart from the softer surrounding parts — the more solid bones of the male skeleton would have made more resistance to violent influences. That the evidence indicates the opposite trend must, therefore, be due not to bone composition but rather to the various ways in which males and females were exposed to their environment, and most probably was closely connected to the division of labor between the sexes (Grimm and Mohr-Siedentopf 1970).

The collected casuistic material in our catalogue differs very much in terms of the reliability of chronological, i.e. cultural(sociohistorical) order, sexual diagnosis, completeness and preciseness of the injuries found, and correctness and distinctiveness of the diagnosis. For this reason, the biostatistical completion of the material has not gone beyond a relatively rough periodization, a summary treatment of all traces of injury, regardless of their location, and an investigation of the confidence limits with the help of Bunke and Weber's tables.

An interim bulletin, containing some 900 known cases, and showing the current state of work on the catalogue, is now complete (Grimm i.p.). Analysis of the 378 cases where sex of the individual could be determined shows that, from the Mesolithic (conclusively from the pre-Roman Iron Age), almost all differences in the frequency of injuries between males and females are significant at the 5 percent level. It also shows, that as from the Neolithic, the empirical percentage figures for the male share of injuries lies beyond the confidence area (as reached with $\alpha = 1\%$) which was found for the percentage frequency of injuries of female skeletons (see Table 1).

Table 1.

	Traces of fracture in male skeletons	Traces of fracture in female skeletons	Margin granted for female share for $\alpha = 1\%$
Paleolithic	10 (40.0%)	13	44.0–93.1
Mesolithic	6 (66.7)	3	5.3–75.0
Neolithic	48 (78.7)	13	10.2–38.6
Post-Neolithic and Bronze Age	31 (73.8)	11	11.9–45.7
Early Iron Age	16 (69.6)	7	11.1–59.3
Roman Iron Age	43 (87.8)	6	3.7–28.6
Period of Germanic migrations	25 (89.3)	3	1.6–32.5
Early Middle Ages	138 (81.2)	32	16.3–32.4
Late Middle Ages	18 (90.0)	2	23.3–76.7

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Neanderthal Remains in Kůlna Cave, Czechoslovakia

JAN JELÍNEK

During an archaeological investigation of Kůlna cave in the northern part of the Moravian Karst in 1970, most of the right parietal bone of a Neanderthal man was discovered. Kůlna cave is situated about thirty-five kilometers north of Brno, in central Czechoslovakia.

Investigations conducted at the cave during the past ten years by the Institute Anthropos Brno have uncovered strata comprising a total of fourteen supersituate archaeological layers. This circumstance makes Kůlna cave stratigraphically one of the most important sites in Czechoslovakia.

Mousterian and Mousterianlike cultures are in evidence in four layers; the youngest layer, the one in which the parietal bone was found, belongs chronologically to the end of the first cold stage of the last Würmian glacial period (Würm I), and is 40,000 to 50,000 years old.

This is not the first discovery of Neanderthal remains in this layer. In 1965 the upper jawbone of an immature boy (fourteen or fifteen years old) was found here. The dimensions of the preserved bone fragment showed that the face of this individual was of exceptional height, as is normal for west European finds from that period. On the other hand, the morphology and size of the teeth in no way differ from the average teeth of *Homo sapiens sapiens.*

The fact that the coronal suture, partly preserved on the parietal bone found in 1970, was on the whole open shows that this was the parietal of a young individual who had not yet reached the age at which ossification of the coronal suture takes place. The thickness of the parietal bone indicates, however, that this individual was, in all probability, a man.

The circumstances do not rule out the possibility that these finds, a maxilla of 1965 and the parietal bone of 1970, which were found in the same layer at a distance of twelve meters from each other, belonged to the

same individual. The thickness of the parietal bone is comparatively great even for an adult male; for a fourteen- or fifteen-year-old boy, it would, however, be exceptional. The edges of the bone are damaged. The bone was apparently battered while the skull was being broken — most probably to remove the brain — and then thrown away. In spite of painstaking efforts, during which the layer was completely scoured for bone, we were unable to discover even the smallest fragments or chips in the area of the find. Thus the bone was not battered in the place where it was discovered.

The find undoubtedly adds to our knowledge of the Moravian Neanderthals of that time. One of the main factors distinguishing the parietal bone of *Homo sapiens sapiens* from that of *Homo sapiens neanderthalensis* is the curve of the transverse cross section of the cranial vault. In the typical west European, the so-called classical Neanderthals typified by the La Chapelle aux Saint find, this transversal curve is relatively flat, while in *Homo sapiens sapiens* skulls it is more domed. This is apparent from a transverse section of the braincase or an occipital view of the skull. I therefore made a mirror image of the uncovered parietal bone and with the help of the preserved part of the coronal suture placed both bones in their original position. The possible variation of their angle of mutual contact is negligible, and it seems clear from their arrangement that, on the whole, they correspond to the shape of classical west European Neanderthals.

I also made another comparison. I made casts of the parietal bones of various examples of *Homo sapiens neanderthalensis* and of *Homo sapiens sapiens* and placed into these casts the parietal bone found in Kůlna cave; in this procedure, the matching or difference in the overall curvature and shape should have been visible at first sight. The match with the La Chapelle parietal was most striking; it was less so with the La Ferrassie, Spy, and Le Moustiere, and even less with the Ehringsdorf (Behm-Blancke 1960). A conspicuous difference was apparent between the Pleistocene *Homo sapiens sapiens* bones from Mladeč and Předmostí; and the greatest difference occurred in the comparison with modern man. In all cases I compared male finds, in order to avoid the differences naturally arising from sexual dimorphism. From the Kůlna cave finds, therefore, we can ascertain that in the Neanderthal bone remains there are salient features reminiscent of west European, so-called Neanderthal man; the teeth display a morphology and size similar to those of *Homo sapiens sapiens.*

Unfortunately, well-dated and documented *Homo sapiens neanderthalensis* finds are, for the time being, very rare in central Europe. The morphological variability and dating of the Ehringsdorf finds merit consideration. The find from the Subalyuk cave in northern Hungary (Bartucz 1940; Szabó 1940) also displays a series of indications pointing to classical Neanderthals. On the other hand, the frontal bone from Šala in Slovakia (Vlček 1969) shows a series of progressive characteristics. It is

undoubtedly necessary to withhold final judgment until further new finds are available.

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The Lombard (Langobard) Man in Space and Time

ISTVÁN KISZELY

According to the Hungarian terminology (Kiszely and Kiszely 1969), archaeologically as well as ethnically, the Lombards (Langobards or Longobards) can be classified best as being part of the peoples of the early migration period (Bóna 1956, Werner 1962).

The purpose of my investigations has been to follow with uniform methods of examination the route of migration of this ethnic group which appear in northern Germany about the beginning of our era (Paulus 744) and merge into the population of Italy about 700 years later. It was necessary for me to examine personally all the finds with identical morphological (Martin 1928) and chemical methods. The solution of many problems was hindered by the following factors:

1. The origin of the Lombards has not been clarified completely. From the archaeological and ethnic point of view we meet them first in northern Germany, in the vicinity of Lüneburg and Bardowick. However, their ethnic origin is not justified scientifically by the anthropological picture of the local population about the beginning of our era, or by considering the "Chauki Germans" or other ethnic groups to be their ancestors. The traces point toward the north, toward Scandinavia, although the data which would settle the debate are not yet in our hands.

2. In Germany, apart from a few graves (Marwendel) and a few poorly preserved skeletal finds, the majority of the Lombards cremated their dead. Thus identifying and defining their types is hardly possible with present scientific methods.

3. In Czechoslovakia, the cemeteries of the Lombards are not so well excavated and explored; they are fragmentary, and the archaeological definition of the finds is also uncertain. Today it is still difficult to separate them from the other peoples of the early migration period (Kiszely 1966; Lebzelter and Müller 1935).

The above-mentioned difficulties of examining the first generations justified our concentrating on ethnic investigations of the Lombards in Austria and Hungary (Jungwirth 1968, Kiss and Nemeskéri 1964; Kiszely 1966, 1970a, 1970b, 1970c, 1971a, 1971b, 1972). In these two countries the archaeological definition of these people is possible. This is explained partly by the complete and up-to-date excavation of the cemeteries and partly by the fact that in these territories the anthropological structure of these people is considerably different from that of the other peoples of the early migration period.

An important point in these two countries is the fact that historically their stay here was short (in Hungary forty-two years) and well documented (Bóna 1956; Paulus 744; Werner 1962). The concentrated Hungarian and Austrian material makes it possible for us to follow the Lombards on their further route. The ethnic group found here — which during its further migration absorbed other people also — merged with the Romans (Kiszely and Scaglioni 1969; Kiszely 1970a, 1970b, 1970c, 1971a, 1971b, 1972). However, in certain places, where the group was isolated (in Friaul, for example), it has survived up to the present time.

Thus the problems of investigation of the Lombards, in addition to their origin, are as follows: what people did they meet in certain territories; and did they carry them along, or did they remain in their own isolation? Among the peoples to be taken into consideration we can mention the aboriginal inhabitants of Germany, the proto-Bulgarians, who met the Lombards between 400 and 448 in northern Europe; the Goths and Heruli from 488 to 526 in Rugiland; the other people of the early migration period in the territory of Hungary between 526 and 568, such as Goths (Ostrogoths), Gepidae, and then, in 568, Avars; in Yugoslavia again they came in contact with the Ostrogoths and the Romans, and finally, in Italy, with the Romans.

I have tried to sum up the results of my investigations in Table 1 and in Figures 1–4. On the basis of my investigations the following facts can be stated:

1. We must seek the final routes of the Lombards in Scandinavia.

2. In Austria the cemeteries that can be regarded as "genuine Lombard" are Oberbierbaum, Hausskirchen, Schwechat, Nikitsch, Strass, Tulln, and Poysdorf. The cemeteries of Erpersdorf, Rohrendorf, Neu-Ruppersdorf, Grosshöflein, and Steinbrunn belong rather to the Gothic ethnic group and, in certain cases, to the local Roman population.

3. In Hungary we can ascribe to the Lombardic ethnic group the cemeteries of Szentendre, Rácalmás, Kajdacs, Bezenye, and Mohács, while the cemeteries of Hegykő (Tóth 1964) and Tamási contain an alien ethnic group. In Várpalota the preserved twelve skeletons available as well as the stray finds do not offer any possibility for the definition of the ethnic group.

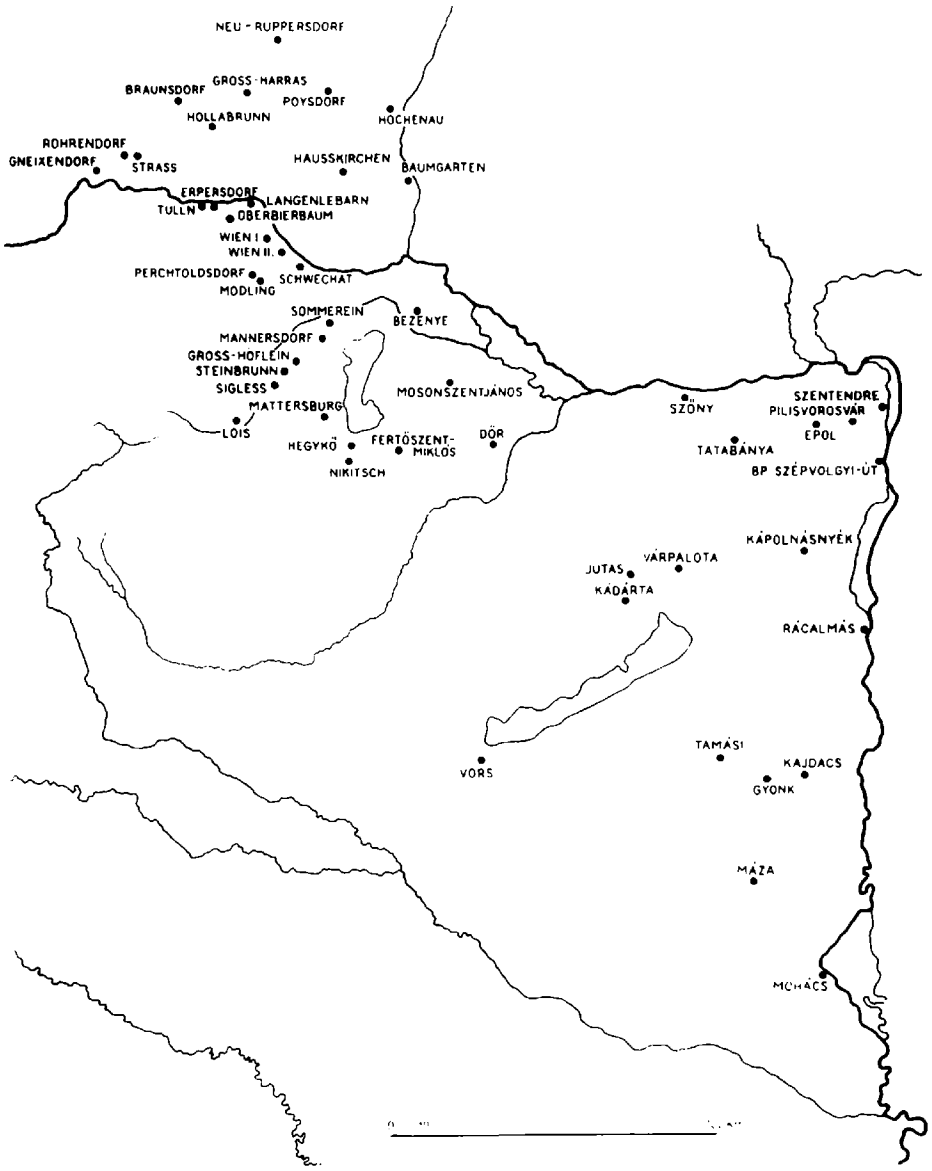

Figure 1. Lombard (or presumably Lombard) sites from Austria and Hungary

4. The cemetery of Kranj (Krainburg) in Yugoslavia contains partly Ostrogoth and partly Roman populations, but Lombards can also be found there.

5. The "genuine Italian" cemeteries are Cividale, Verona, Vicenza, Reggio Emilia, and Brescia I, as well as Testona (Kiszely and Scaglioni 1969), where only the men can be regarded as Lombards. Roman populations can be found in Castel Trosino (Kiszely 1971a) and Brescia II (Kiszely 1970c). Dolianova can be regarded as partly Lombard, partly a mixture of local but non-Roman populations.

6. In the course of the Lombard's 700-year migration we can definitely

Table 1. The Penrose distances of different Lombard-age grave yards (total: 769 graves; the basis of comparison is a well-determined Longobardic series)

	Males				
Graveyard	No. of graves	Size	Shape	C_R^2	Generalized distance (D_p^2)
Austria					
Oberbierbaum	43	0.04	0.10	0.12	1.40
Hausskirchen	20	0.10	0.11	0.14	1.34
Poysdorf	5	0.03	0.10	0.12	1.40
Schwechat	14	0.09	0.10	0.11	1.56
Nikitsch	8	0.06	0.13	0.16	1.81
Erpersdorf, Rohrendorf	16	0.16	0.25	0.28	4.62
Neu-Ruppersdorf	8	0.11	0.28	0.31	5.24
Grosshöflein	11	0.12	0.30	0.34	4.42
Mannersdorf	5	0.11	0.31	0.33	6.57
Steinbrunn	10	0.16	0.16	0.18	1.81
Sporadic fluids (28)	14	0.15	0.26	0.28	3.45
Hungary					
Szentendre	43	0.07	0.10	0.11	1.31
Rácalmás	6	0.04	0.11	0.14	1.28
Sporadic finds (21)	10	0.11	1.18	0.20	2.30
Kajdacs	16	0.08	0.13	0.14	1.89
Tamási	2	0.03	0.16	1.18	1.40
Hegykő	10	0.11	0.30	0.38	5.64
Várpalota	5	0.12	0.28	0.30	4.89
Yugoslavia					
Kranj	41	0.20	0.48	0.49	7.41
Italy					
Cividale	6	0.03	0.18	0.21	1.98
Verona, Vicenza	4	0.05	0.16	0.18	2.00
Testona	16	0.09	0.22	0.23	2.84
Brescia, Gussago	8	0.14	0.16	0.19	4.91
Castel Trosino	16	0.20	0.35	0.44	6.61
Reggio Emilia	8	0.11	0.39	0.41	5.16
Sporadic finds	11	0.10	0.16	0.23	4.47
Dolianova	16	0.18	0.46	0.48	6.66
Total	372				

Measurements:
1. Maximum cranial length (M: 1);
2. Maximum cranial breadth (M: 8);
3. Nasion–gnathion height (M: 47);
4. Bizygomatic breadth (M: 45);

Females				
No. of graves	Size	Shape	C_R^2	Generalized distance D_P^2
46	0.03	0.12	0.14	1.56
16	0.09	0.11	0.13	1.42
4	0.04	0.11	0.12	1.38
18	0.08	0.10	0.12	1.36
11	0.07	0.14	0.16	1.91
19	0.14	0.28	0.30	4.95
7	0.10	0.29	0.31	6.51
16	0.14	0.32	0.36	5.99
7	0.11	0.33	0.34	7.63
14	0.11	0.17	0.17	1.78
14	0.16	0.35	0.36	3.96
46	0.08	0.12	0.14	1.40
5	0.03	0.14	1.16	1.28
11	0.16	0.19	0.22	2.26
17	0.09	0.13	0.16	1.76
7	0.04	0.15	0.16	1.56
10	0.11	0.33	0.36	7.80
6	0.10	0.20	0.25	5.60
40	0.21	0.52	0.56	6.91
5	0.04	0.10	0.13	1.85
2	0.06	0.18	0.20	2.16
15	0.08	0.28	0.31	4.80
9	0.13	0.18	0.20	5.06
18	0.18	0.30	0.38	6.80
11	0.11	0.38	0.43	5.90
8	0.13	0.19	0.26	4.99
15	0.17	0.46	0.56	7.01
397				

5. Cranial index (M: 8: 1);
6. Total facial index (M: 47: 45);
7. Robusticity index of the clavicle;
8. Breadth–height index of the cranium (M: 20: 8);
9. Stature (Bach-Breitinger);
10. S^2 of the cranial indexes (M: 8: 1).

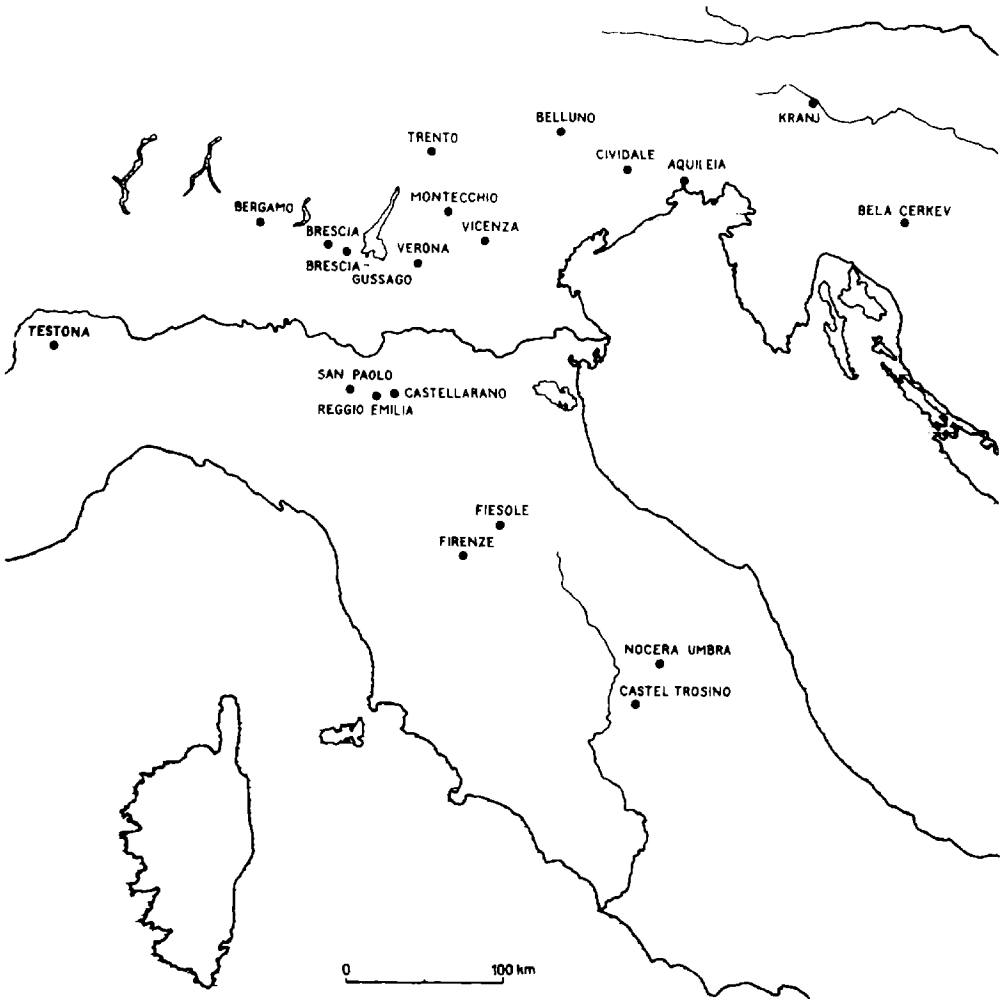

Figure 2. Lombard (or presumably Lombard) sites from Yugoslavia and Italy

find a leading Lombard layer which preserved its ethnic characteristics during the whole period.

7. A considerable degree of brachycephalization takes place in the territory of Rugiland under the influence of the Heruli living there (Grafenwörth).

8. In Austria and in Yugoslavia the Lombards met some ethnic groups from eastern Germany. In several graves deformed skulls can be found. However, these individuals show the Taurid-like variant typical of the Ostrogoths. The deformation of the skull cannot be found on any individual positively identifiable as Lombard.

9. In Italy the Lombards can be separated from the local population only in the area of Friaul and other northern regions, and only at the end of the sixth century and the beginning of the seventh century. The composition of the Castel Trosino cemetery (on the basis of the skeletal finds available for elaboration) is mostly Roman, but even negroid elements can be found in it.

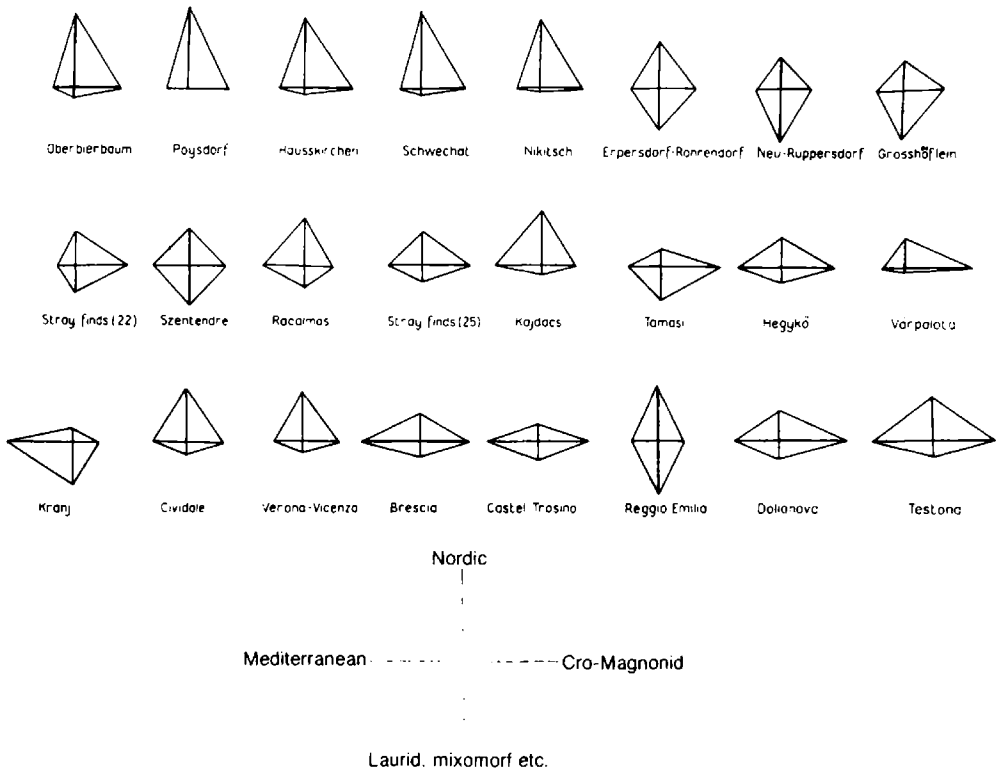

Figure 3. A graphic presentation of some anthropological characteristics (size of skull, morphological face marker, skull marker, stature); the average characteristics of the Szentendre cemetery serve as basis of comparison

10. Anthropological data (Lombard) from southern Italy (Salerno, Benevento) are not available to us.

My further investigations are concerned therefore with the clarification of the origin of the Lombards and the authentication of the finds from Czechoslovakia, as well as with the investigation and elaboration of Lombard cemeteries in southern Italy. Currently in progress is a comparison of the contemporary Lombard human representations of the early migration period and the works written about it, with the nearly 1,000 individual finds made so far. The purpose of this is to ascertain whether or not, beyond the contemporary affectedness of the "barbarian," artists have represented the character typical of the ethnic group, and whether or not the finds verify the facts mentioned in the sources.

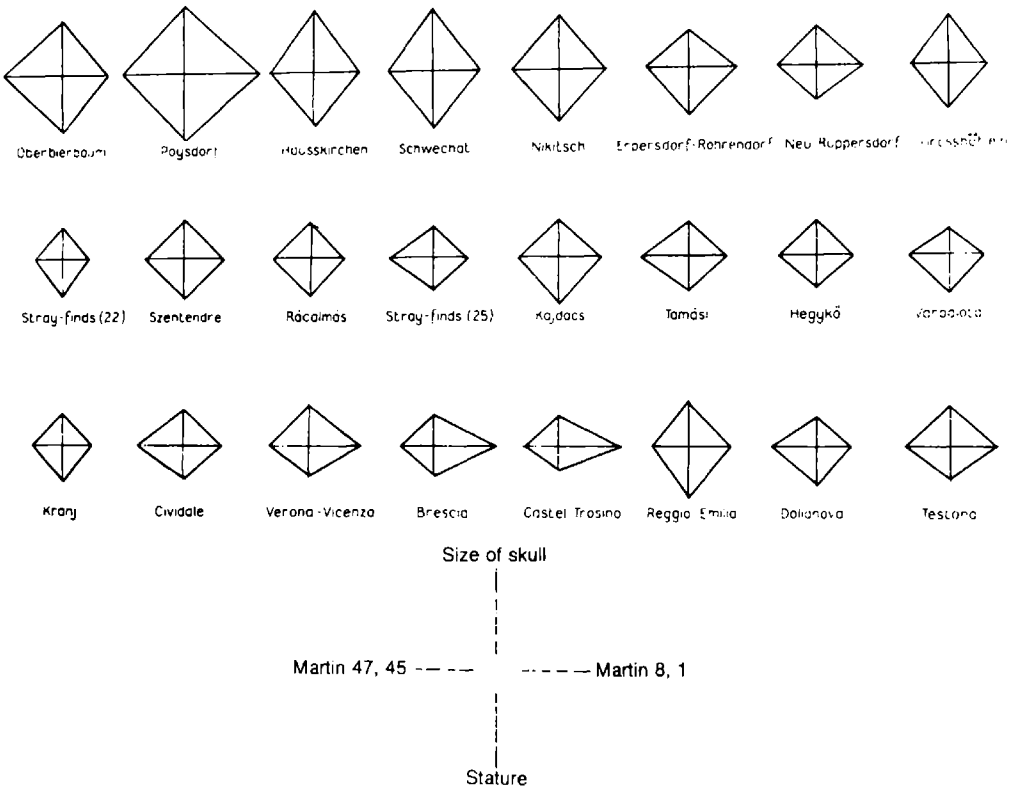

Figure 4. A graphic comparison of the anthropological types of the Lombard cemeteries compared to those from the cemetery of Szentendre

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Physical Anthropology of the Finno-Ugric Peoples

P. LIPTÁK

The Finno-Ugric peoples belong to the Uralian family of languages. The latter also include different Samoyed peoples (Hajdú 1968).

For more than a thousand years the Hungarian people, the largest population group (about fourteen million) among the Finno-Ugrians (more exactly among the Ugrians) have lived in the Carpathian basin in middle Europe. Other Finno-Ugric peoples — Estonians, Mordvinians, Udmurts (Votyaks), Cheremiss, and Komis (Zyrians) — live in the Soviet Union. Those who are most closely related linguistically to the Hungarian people, the small Vogul and Ostyak population groups, can be found in the *taiga* zone [coniferous forest] of western Siberia.

There is a good comprehensive work by Aul (1964) about Estonians and another one by Mark (1970) about Finno-Ugrians living in the Soviet Union. A considerable historical anthropological work by Debec (1948) and many papers by Trofimova and others, giving a good account of the physical anthropology of the Finns, are of great importance as well.

Skeletal finds of ancient Finno-Ugrians (Lugovskoi) were studied chiefly by Trofimova (1941, 1968). The Hungarian János Jankó collected Ostyak crania from the nineteenth century along the Iugan, a subsidiary stream of the middle Ob; these crania were investigated by the author (Lipták 1950). A very concise comprehensive study was published by Čeboksarov (1952). Metrical and morphological data concerning the living Ostyak population have been put down in a handwritten diary by János Jankó; these data were similarly studied by the author (Lipták 1954).

Ancient Finno-Ugrians, according to our present knowledge, were probably of Europoid character with a predominance of Cro-Magnon and Nordic characteristics.

During the transition period between the Bronze Age and the Iron

Age, Ugrians from the Siberian *taiga* zone were influenced, in several waves, by Mongoloids; as a result of this influence, the Uralian (Ugrian) race, including the Ugrians of the Ob, developed. It is mesocephalic, has a complexion of mixed colors, is of short stature, and has a moderately protruding nose; a brilliant analysis of the Ugrians is given by the Hungarian Károly Pápai (1894); this study has, unfortunately, been ignored by most anthropologists.

Finno-Ugric ethnic groups started to migrate from the original Uralian home between the Volga River and the Ural mountains (the region can be outlined chiefly on the basis of linguistics) in the third millennium B.C. In the opinion of several scholars, the unity of the Finno-Ugric prehistoric peoples must be dated even earlier.

The ancestors of the Hungarians, who spoke the Ugrian language, lived in clan organization in the wood–steppe zone of Eurasia, along the rivers Káma and Belaia, in the area of modern Bashkiria. Some of the Hungarian tribal names have survived in this region (Németh 1966). The Ananino culture used to be connected with the proto-Hungarians or with one of the Finno-Ugric tribes. Skeletal finds from the cemetery of the culture of Ananino (named Lugovskoi) are predominantly of Mongoloid character, but they include some Cro-Magnon elements as well.

The complicated ethnogenesis of the Hungarian people consists of three threads twining together (Lipták 1970a, 1970b). The Ugric-Hungarians, migrating southward from the original home, led a semi-nomadic life in the wood–steppe zone; they came in contact with the Onogur Turks (Bulgar Turks), whose descendants, the Chuvash, live near the Volga River even today. The Hungarian people, who incorporated some Onogur ethnic elements, first lived within the empire of the Khazars, descendants of the Sabirs living north of the Caucasus; they also lived on the western border of the Khazar empire, in Lebedia, and then, having migrated westward, in Etelköz. Their connection with the Onogurs is suggested by the existence of a number of Bulgar Turk linguistic borrowings, as well as by anthropological similarities especially between the upper circle of the conquering Hungarians (Lipták 1958) and the population of the Bulgarian cemetery of Bolsie Tarhany (in Hungarian, "Nagy-Tárkány") near the Volga River from the eighth and ninth centuries. The Turkish component of the Hungarian people is characterized by Turanian and Pamirian anthropological components and, subordinately, components of the "Andronovo" type. The process of becoming a people was completed for the Hungarians in the Carpathian basin (in the middle Danube) in a very complicated way. The process that took place in the Carpathian basin can be divided into two parts:

1. The period between the sixth and ninth centuries, before the Hun-

garian conquest, dated A.D. 896; the Avar age (from 568 until about 800) was particularly important.

2. The period of the conquest (the end of the ninth century through the tenth century) and the Arpadian age, that is, the age of kings of the House of Árpád (eleventh through thirteenth centuries).

The conquest of Hungary, in all probability, took place in several phases; it may have even started during the so-called Pre-Avar period, at the time when, in Simonyi's opinion (1959) the first ancient Bulgarian tribes appeared in the Carpathian basin.

CONCLUSION

The main results of this paper and of other works by the author (which focus on the Hungarians and are quoted above) can be summarized as follows:

1. The first phase of Hungarian ethnogenesis refers to the double-rooted origin of Hungarian people. Hungarians who spoke the Ugrian language belonged to the Finno-Ugrian (actually, Ugrian) family, but in the third millennium B.C. had already separated from the Ugrian line.

2. In the region of the Káma and Belaia rivers, the area of modern Bashkiria, proto-Hungarians came in contact first with Iranian peoples (Scythians, Sarmatians) and later with Onogurs (also called Bulgar Turks), who influenced their language and culture. Here we can find the other root of the origin of the Hungarian people. Studies in physical anthropology have revealed the appearance of Turanian, Pamirian, and Mediterranean (Pontian) components.

3. The third line or component of the ethnogenesis of the Hungarian people was constituted by very heterogeneous populations in the Carpathian basin, predominantly the Avars (Varkhonites) who, after settling there in 568, introduced many new ethnic and racial components. Hungarian tribes probably appeared in several phases, beginning as early as the fifth century.

4. The conquest proper of Hungary is dated at the end of the ninth century, in 896, when the seven Hungarian tribes (Nyék, Megyer, Kïrt-Gyarmat, Jenó, Tarján, Kér, and Keszi) and the three Kabar tribes, led by Prince Árpád, gradually filled up the Carpathian basin, except for the zones of beechwood and the coniferous forests. The "conquering Hungarians" are equivalent to the upper circle of the people (with rich furniture); some of them spoke two languages: Onogur-Turk and Ugrian-Hungarian.

The social arrangement of Hungarians of the tenth and eleventh centuries, which involved an upper circle, a middle circle, a military escort,

and the commoners, has been substantiated by palaeoanthropological investigations.

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Physical Anthropology of Early Egyptians

MELCHIORRE MASALI

The main problem of studying early populations from skeletal material lies in the limited availability of complete skeletons such that most of the vital parameters of the population can be detected and analyzed. This paper deals with a synthesis of the research that has been done in the last few years on the Giovanni Marro osteological collection of early Egyptians at the Institute of Anthropology in Turin. The collection (Davide 1972) consists of 1,118 skeletal remains and 105 mummies, and from this material as large a number of samples as possible has been taken to meet the various requirements of the research.

One of the interesting characteristics of this collection is the completeness of at least 400 skeletons, ranging from juveniles to adults and from early dynasties to Ptolemaic times (predynastics are separate). Moreover the skeletons are of common people; that is, of individuals living in direct contact with the natural environment of the upper Nile Valley, in Asiut, Gebelen, and Aswan.

If we take into account that the skeleton, from a biological point of view, bears the impressions of locomotor apparatus and, in a more general sense, of the interrelation of the body with the external environment, by both selective and individual adaptation, it may be suggested that a wide range of information concerning population biology may be obtained by the study of the bones.

Much emphasis will be given in this paper to this kind of evidence.

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DEMOGRAPHY

Demographic data on the population as a whole have been determined on a sample of 749 skulls (Masali and Chiarelli 1972) of the dynastic collection; predynastics and juveniles were studied separately. Sex and age have been determined from the skulls alone, with the aim of enlarging the sample (skulls are available in larger number than complete skeletons) and to avoid errors in the pelvis-measurement discrimination, since male and female pelvises of this population display considerable structural similarity (Masali and Davide 1966).

The sex ratio (male to female) is 1.09 for the dynastics and 0.72 for the predynastics, but the sex ratio varies widely at different death ages, showing a peak of mortality between twenty and thirty years for both sex groups, but with a higher mortality in females, probably as a consequence of child birth. The juvenile individuals show a mortality trend that decreases with age but is probably affected by different burial traditions, causing the loss of the remains of very young individuals.

It may be observed that early Egyptians, like many other early populations, had a short average life span. The population was therefore formed of young adults with a very small number of inactive individuals. Nevertheless, it was not an expanding population; in consequence, it was well fitted to its habitat, with a good equilibrium between the resources of the land and the fertility of the inhabitants (Masali and Chiarelli 1972). From this point of view a study of the skeletal characteristics of the population and its relationship to the environment seems of some utility.

POPULATION HOMOGENEITY AND EPIGENETIC TRAITS

The biological homogeneity of the population in the collection, especially of its basic stock (Gebelen predynastics, Gebelen dynastics, Asiut dynastics) has been tested as to the frequency of the epigenetic traits of the skull, according to the methodology of Berry and Berry (1967), using a sample of thirty individuals of each population component. While the calculation of distance will be done on all available skulls, the simple comparison of the percentage frequency seems indicative of great isolation in time and space.

In particular it may be observed (Reggio et al. 1969) that the Gebelen population components appear genetically homogeneous from predynastic to dynastic times, as is indicated by the virtual absence in the dynastics of epigenetic traits not preexistent in the predynastics. Also, the Asiut population component shows a strong similarity to the Gebelen population, despite some differences, perhaps due to the fact that they belonged to different familial lines.

BODY BUILD AND CONSTITUTION

The body build of early populations is a good source of information about their adaptation to their environment. While a complete physical analysis is frustrated by the lack of soft tissues, the amount of data furnished by bones can nevertheless give a fairly wide range of information.

The most common dimensional information generally given for skeletal material is stature. This parameter is unfortunately biased by calculation techniques based on regression equations that are calibrated on populations other than the one being studied. Skeletal length in the *normalstellung*, when the reconstruction is possible, or combined measurements of longitudinal elements can give unbiased information on the dimensional characteristics of the body.

A combination of longitudinal and transverse dimensional parameters of the body can be used as a starting point for a constitutional study of the population, to discover the "morphosomatology," in the terminology of Correnti (1960). A further approach to the knowledge of body composition can be made when bone robustness, bone volume, and muscular insertions are taken in account. Studies of this kind have been done and are still underway on the Gebelen–Asiut population.

The skeletal length in the Gebelen–Asiut population averages 157 centimeters in males and 148 centimeters in females and shows the highest correlation (r) with the stature calculated from long bones according to the methods of Telkka (1950) (0.53 for males, 0.48 for females) and of Trotter and Gleser (1952) for negroes: 0.68 for males, 0.46 for females (Masali 1972). Recent measurements of bodies *in situ* from Der el Medina (XVIII Dynasty) according to the method of Dupertuis and Hadden (1951) show a strict correspondence between the calculated stature and the length of the mummified body (Volante, personal communication). The problem of what the Egyptians' stature really is is nearly solved in the studied population. The combination of longitudinal and transverse parameters given by the modules (longitudinal modules = sum of lower limb bones + sum of vertebrae thickness; longitudinal module = pelvis breadth + 2× clavicle length) shows a tendency to a slimming process from predynastics to dynastics, and at the same time a reduction in sexual dimorphism. From this point of view it may be observed that one of the main indicators of body sexual morphology, the pelvico-clavicular index, shows in early Egyptians the smallest difference between the sexes in comparison with other human populations, a difference, moreover, which decreases from predynastics to dynastics (Masali 1972). The combined process of slimming and sexual morphology convergence indicates a tendency toward gracilization.

THORAX MORPHOLOGY

The thorax may be considered to be sensitive to environmental adaptation, as it is directly influenced by the breathing function and carries the insertions of the upper limb motor muscles. Variations may be both phenotypic and genetic. From this point of view the morphology of the thorax (i.e. the shape of the ribs) may show bilateral asymmetry related to possible different muscular training of the left or right upper limb.

The study of the thorax is rather uncommon for the trivial reason that ribs are rarely preserved in a state good enough for a systematic study. Pastore's study (1935) on the aboriginals of Tierra del Fuego (fourteen individuals) was made from this point of view. Following the methodology of Pastore, fifty individuals of both sexes from the Gebelen–Asiut collection were studied and compared. The comparison may be informative since Egyptians and Fuegids lived in extremely different environmental conditions with little cultural adaptation (especially the Fuegids).

It may be observed that, while in the Fuegids the rib arches are wider on the right side of the body in both sexes (except for the ninth and tenth ribs in females), in the Egyptians the dimensions are more randomly distributed. The arch chord is instead slightly more prevalent on the left side. Nevertheless the curvature index tends to show a random distribution between left and right. The female thorax is also less curved than the male, as a consequence of the relatively longer chord in females.

The costometric method seems to give some adaptation information and it is worth ascertaining when the rib remains are available.

VERTEBRAL COLUMN

The vertebral column is also a highly informative structure from the point of view of the physical activity and environmental adaptation of a population, because it is highly sensitive to natural and artificial posture effects.

It is nearly impossible to reconstruct the whole column from skeletal material owing to the lack of information about the disc shape, but it is possible to study the shape of the sole osseous component.

The reconstruction pattern of the body column is the "rachigram" (Masali 1967, 1967b; Masali et al. 1968). The rachigrams of the Gebelen–Asiut population show an approximately equal number of vertical and retroverted patterns and a less frequent number of ventrally bent columns in males, while in females slightly more than half of the vertebral columns are ventrally bent. This fact may be an indication of the different physical activities of the two sexes, rather than of purely sexual differences.

It must be observed that the disc morphology generally compensates

for the shape of the osseous component of the vertebral column, as it has been possible to observe in living subjects (Masali and Vallauri 1969). This fact makes possible the existence of inverted curvatures of the osseous component in relation to the physiological curves (*eigenform*) without deformity in the living. The highest compensation that may be argued for females, as a consequence of their higher frequency of curve inversions (ventral instead of dorsal and vice-versa), is that this may indicate a greater mobility of the column.

Unfortunately there is little opportunity to make comparisons with other early human populations since the method requires an absolutely complete preservation of the vertebrae, a condition that is frequent only for Egyptians.

GROWTH

Growth in ancient populations can be estimated only from juvenile skeletal remains, thus excluding from the study the healthy individuals whose growth has not been arrested by death. Any juvenile sample may thus contain some individuals whose growth has been influenced by illness or food deficiency. Nevertheless, juvenile remains are our only source of information, so they are worthy of study when, as in the case of the Gebelen–Asiut collection, the number of individuals is large enough to build up a complete growth series.

Dental age combined with long-bone ossification can give a suitable physiological chronology to build up age classes. Obviously the parameters that are used for age determination cannot be used again.

An attempt to study morphometric variations of skull and pelvis during growth on the Gebelen–Asiut collection (Fumagalli 1960; Masali 1960) was done years ago, while recently a survey of the whole skeleton has been completed on the juvenile section of the collection (149 individuals) from newborns to young adults (spheno-basilar sinchondrosys as skeletal maturity indicator). We intend to study growth using an age–length regression method. Preliminary data are given in the Appendix.

APPENDIX

Table I. Body morphometry of the Gebelen–Asiut early Egyptians (in centimeters)

Method of figuring stature	Males	Females
Skeletal length	157	148
Telkka	168	156
Dupertuis	172	158
Trotter	w. 168 n. 164	w. 157 n. 157
Manouvier		
dynastics	166	156
predynastics	165	157
Pearson	162	153
Longitudinal module	123.5	115.1
Transverse module	55.2	51.4
Pelvico-clavicular index:		
dynastics	91.0	92.4
predynastics	90.9	93.0

Table II. Skeletal robustness, traditional robustness index, volumetric index ($\sqrt[3]{V}/L$), muscularity, *in vivo* skeletal weight estimations (partially provisional data)

	Robustness index	Volumetric index	Muscularity scores		Skeletal weight (in kilograms)
Homerus:					
male	18.6	1.44	9	1.0	
female	17.8	1.41	9	1.4	
Radius:					
male	16.6	1.33	9	1.0	
female	15.7	1.33	8	1.0	
Ulna:					
male	13.7	1.29	–		8.7
female	13.4	1.28	–		
Femur:					
male	19.1	1.69	9	1.4	
female	18.1	1.68	8	1.0	5.6
Tibia:					
male	19.3	1.77	–		
female	18.1	1.72	–		
Fibula:					
male	9.3	1.06	–		
female	9.1	1.09	–		
Innominate bone:					
male	–	–	9	1.0	
female	–	–	8	1.0	

Muscularity scores: 7 = very weak; 8 = weak; 9 = medium weak; 10 = intermediate; 11 = medium strong; 12 = strong; 13 = very strong.

Table III. Frequency of curvature (incuneation) of different regions of the rachis and of the entire vertebral column in the rachigram (Gebelen–Asiut population) (provisional data)

	Ventral curvature (percent)	Straight (percent)	Dorsal curvature (percent)
Cervical:			
male	16.7	27.8	55.5
female	27.3	13.6	59.1
Thoracic:			
male	57.9	15.8	26.3
female	66.7	14.3	19.0
Lumbar:			
male	37.0	31.6	31.6
female	42.9	38.1	19.0
Total:			
male	26.4	36.8	36.8
female	57.2	23.8	19.0

Table IV. Linear age–length regression in skeletal growth of the Gebelen–Asiut dynastic Egyptians (provisional data)

Parameter	Number	a	b	Age range	$\bar{x}$ years	$\bar{y}$ centimeters
Humerus	34	14.1	0.8	4–20	12.0	23.7
Radius	23	10.4	0.7	1–20	12.0	18.8
Ulna	10	11.2	0.6	5–20	14.8	21.2
Clavicula	77	7.0	0.3	1–20	7.0	9.1
Femur	53	19.1	1.3	1–20	9.0	30.8
Tibia	42	17.1	1.1	2–20	10.0	28.9
Fibula	10	31.6	0.06	11–20	15.7	32.2

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A Study of Human Teeth from a Villanovian Necropolis in Veio

P. PASSARELLO

A study has been carried out on human dental remains from a Villanovian necropolis in Veio, a well-known center of southern Etrurian civilization.

This population sample dates back to the Iron Age and lived in upper Latium in the early centuries of the first millennium B.C.

The habitat of the Villanovians, so called after the necropolis of Villanova (Bologna), was characterized by body cremation rites and included an extensive portion of central and northern Italy that essentially comprised Latium, Umbria, Tuscany, and Emilia-Romagna.

This population is important also from the demographic angle, as witnessed by the large burial grounds, a real expanse of urns extending from the Tyrrhenian to the Adriatic coasts.

The Villanovian civilization emerged in several centers of Upper Latium (Tolfa, Allumiere, Tarquinia) late in the second millennium B.C. From these centers the Villanovian culture spread northeast, invading the said areas. In Bologna, the Villanovian age started in 930 B.C. or thereabouts. A gap of two centuries thus exists between the earlier pre-Villanovian manifestations of Tarquinia and the Villanovian manifestations of Bologna. Then came a period during which the Etruscan civilization gradually replaced the Villanovian.

MATERIALS AND METHODS

The teeth studied are from 135 individuals, some of whom were cremated and some buried; generally, only the crown is in a good state of preservation.

On the dental crown, in addition to some features of a pathological character, the mesio-distal and bucco-lingual diameters were deter-

mined. The crown index was also calculated from the values of these dimensions.

Sex could not be determined, owing to the impossibility of obtaining significantly reliable results.

The age of each individual was roughly deduced, in the case of deciduous or permanent dentition, from the extent of attrition observable on the occlusal surface; while in the case of mixed dentition, it was deduced, with a higher degree of accuracy, from the simultaneous presence of teeth of the first and second dentition as well as from the extent of attrition of the teeth of the deciduous dentition. The individuals under examination were then divided into six age groups, according to the suggestions put forth by Vallois (1960:186–222): infantile I (birth to six years of age); infantile II (six/seven to twelve/thirteen years of age); juvenile (twelve/thirteen to twenty-one years of age); adult (twenty-one to forty years of age); mature (forty to fifty-nine years of age); senile (sixty-plus years of age).

RESULTS AND ANALYSIS OF DATA

The mean values of the bucco-lingual and mesio-distal diameters were studied on the best-preserved tooth specimens. The relevant results appear in Tables 1 and 2, which also show the crown index as calculated from the ratio between the two diameters under consideration. In the case of Villanovians, the mean values of the two diameters considered are similar to those of other European populations while clearly differing from those of the human groups of central and eastern Asia, which usually present the highest values for both diameters of the dental crown.

As regards the crown index, it should be noted that Hrdlička

Table 1. Mean values relating to the mesio-distal and bucco-lingual diameters and to the crown index of the deciduous teeth of Veio Villanovians

	I^1	I^2	C	M^1	M^2
Maxillary teeth					
Number of teeth examined	14	18	25	29	27
Mesio-distal diameter (mm)	6.4	5.5	6.6	7.0	9.0
Bucco-lingual diameter (mm)	–	–	5.8	8.3	9.8
Crown index	–	–	87.9	118.6	108.9
	I_1	I_2	C	M_1	M_2
Mandibular teeth					
Number of teeth examined	12	15	17	26	29
Mesio-distal diameter (mm)	4.2	4.7	5.7	8.1	9.7
Bucco-lingual diameter (mm)	–	–	5.5	6.6	8.2
Crown index	–	–	96.5	81.5	84.5

Table 2. Mean values relating to the mesio-distal and bucco-lingual diameters and to the crown index of the permanent teeth of Veio Villanovians

	I^1	I^2	C	Pm^1	Pm^2	M^1	M^2	M^3
Maxillary teeth								
Number of teeth examined	23	24	33	23	19	32	27	19
Mesio-distal diameter (mm)	8.7	6.5	7.6	6.8	6.6	10.3	9.1	8.7
Bucco-lingual diameter (mm)	–	–	8.4	9.2	9.0	10.8	10.5	9.8
Crown index	–	–	110.5	135.3	136.4	104.9	115.4	112.6
	I_1	I_2	C	Pm_1	Pm_2	M_1	M_2	M_3
Mandibular teeth								
Number of teeth examined	18	16	24	21	23	35	26	11
Mesio-distal diameter (mm)	5.4	5.8	6.8	6.7	6.7	10.8	10.4	9.8
Bucco-lingual diameter (mm)	–	–	7.5	7.4	7.8	9.9	9.7	9.2
Crown index	–	–	110.3	110.4	116.4	91.7	93.3	93.9

(1923a:195–216) has studied, from the anatomical and comparative angle, the two first lower molars, dividing the values into the following three groups: dolichodont ($x-89.9$); mesodont ($90.0-99.9$); and brachydont ($100.0-x$).

Hrdlička is of the opinion that dolichodontia represents a more primitive condition than brachydontia. On the basis of this classification, both the first and the second molars of the Veio Villanovians fall into the mesodont class. Selmer-Olsen (1949:104) points out, however, that the value of such an index to assess primitivity is hardly reliable.

As regards the death age of the Villanovians of Veio, shown in Table 3, it appears that 46.7 percent of them did not live longer than thirteen years. The true percentage is even higher, for a certain number of individuals who were stillborn or who died soon after birth should be added to the total. There was, therefore, a notable incidence of infantile mortality in the overall mortality picture. Mortality decreased abruptly (6.7 percent) among young people (thirteen to twenty-one years of age). At the age of twenty-one, sixty-three individuals were still living (46.7 percent); of these sixty-three individuals, forty-one (30.4 percent) did not exceed forty years of age, twenty (14.8 percent) the mature age, and only two (1.5 percent) crossed the threshold of sixty years, an age that was quite exceptional for the inhabitants of Veio in the Iron Age.

Table 3. Mortality in Veio Villanovians

Age groups	Infantile I	Infantile II	Juvenile	Adult	Mature	Senile
Years of age	(0–6)	(6/7–12/13)	(12/13–21)	(21–40)	(40–59)	(60–x)
Number of individuals	39	24	9	41	20	2
Percent	28.9	17.8	6.7	30.4	14.8	1.5

To conclude with some notes of macroscopic dental pathology, it may be said that no evident signs of caries were detected, and those few that were found involved only a negligible number of teeth. Moreover, none of the following conditions were found to any significant extent: dystrophies, cervical erosions, or structural defects such as, for instance, marked enamel hypoplasia or malformations of volume, with the exception of a certain number of third microdont molars.

SUMMARY

A study has been carried out on human dental remains from a Villanovian necropolis in Veio of the Iron Age. The mean values of the bucco-lingual and mesio-distal diameters are similar to those of other European popu-

lations. As regards the death age of the Villanovians it has been found that there was a notable incidence of infantile mortality in the overall mortality picture, while only 1.5 percent of the individuals studied crossed the threshold of sixty years, an age that was quite exceptional for the inhabitants of Veio during the Iron Age. To conclude, it may be said that evident signs of caries and structural defects were found on only a negligible number of teeth.

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Paleodemography of Ancient Slavs

MILAN STLOUKAL

The migration period in the territory of what is now Czechoslovakia was followed by an epoch characterized by a symbiosis of two ethnic elements, the Slavs and the Avars. This Slav–Avarian period included, in fact, the whole seventh and eighth centuries, and on this base the Great Moravian Empire, with its prime in the ninth century, was created. In the beginning of the tenth century, the Great Moravian Empire disintegrated under the repeated invasions of the Hungarians, but from its traditions there grew the Bohemian state in the west and also the symbiosis of Slavs with the Hungarian element in the east.

In the past quarter of this century, archaeological excavations have uncovered a relatively large number of cemeteries from that period. There are skeletal burial places which to a great extent present a sufficiently reliable base for paleodemographic research. In the territory of Czechoslovakia, we already know of nearly 10,000 graves from that period, more than half of them from completely excavated cemeteries with well-determined anthropological material on the age and sex of the deceased. Thus the preconditions of paleodemographic research are fulfilled perfectly in the cemeteries from the Slav–Avarian period in Holiare, Nové Zámky, and Želovce; the Great Moravian graveyards in Mikulčice and Josefov; and the material from the eleventh century in Abrahám. Unfortunately, there exist certain little differences in the estimates of age and sex by different authors, so materials evaluated by a single author are the most dependable.

We can point out some traits characteristic of the majority of cemeteries from this period. The curve of mortality begins mostly with a peak for the group of zero to six years and then sinks for the juvenile group of fourteen to twenty years. In the skeletons of persons older than twenty years, we can distinguish the curve for men and for women, and

these curves have different courses. In the feminine part of population there is a peak of mortality close to thirty years; the peak of mortality for men is regularly after forty years. Only a few persons lived to see an age older than sixty years, but it is interesting that among the few senile skeletons in the Slav–Avarian period, those of women predominate while in the Great Moravian cemeteries those of men appear in greater numbers.

The differences between the males and females definitely appear in the calculation of the average life span. The total average for different populations varies roughly in the limits between twenty-five and thirty-two years; for adult men it is about forty-six years, and for adult women some five years lower, around forty-one years. The explanation here is evident: a great number of women died in pregnancy and during childbirth. Direct proof for this theory does not exist, of course; the percentage of graves containing the remains of one woman and one newborn child is very low, less than one percent of the whole number of women's graves.

The elucidation of some questions in connection with the mortality of nonadults is more complicated. First of all, we regularly find an insufficient number of child skeletons, that is, skeletons of newborns and of children who died in the first months of life. Given the average life span of around thirty years, we could expect nearly 45 percent of the skeletons to be those of children younger than fourteen years, but we find approximately 10 percent less than that in the Great Moravian and Slav–Avarian cemeteries. The skeletons of children in these graves amount to only some 35 percent of the total. I do not believe that the bad state of preservation or the later destruction of material can account for this. It seems that in fact some of the children, especially some of the newborns, were not buried in the cemetery, perhaps for the reason that the dead newborn was not considered a man, or perhaps because later an unbaptized child was not allowed to be buried in the holy soil of the churchyard, or perhaps because there existed some form of intentional selection. It is beyond dispute that only skeletons of the youngest children are missing in large numbers. Even in the nineteenth century, 30 percent of the total number of deaths were among children under the age of one year, but in the ancient Slavonic finds skeletons of this age group average only 5 percent. The highest known value is in the perfectly excavated cemetery in Josefov: 10.6 percent.

An interesting question is the sum relation between the skeletons of adult men and women in the cemetery. I mention, first of all, the factors distorting the situation in the graveyard in contradistinction to the actual population. A low number of male skeletons, for instance, can be explained by the fact that a number of men died in battle, away from their homes, and were buried on the battlefield. On the other hand, the trading objects in the slave markets were, according to historical reports, mainly

women and, if we admit the possibility of the wiping out of the newborn, then the majority of the victims of this custom, widespread in Europe at that time, were probably the newborn girls. Some changes in the natural structure of the population were also caused by the fact that the great centers attracted men as warriors and as artisans.

In the cemeteries from the Slav–Avarian period we can establish a prevalence of female skeletons. We can give the example of the largest known cemetery of this date, the one in Želovce, which contains 870 graves. The masculine index here amounts to only 582; that is, according to the evidence in the cemetery, for each 1,000 women in the population, there would have been only 582 men. I will give two other characteristics of this graveyard: from the archaeological point of view it is interesting to note that a great number of arms were found, and the site of the find indicates that it may be the cemetery of a guard barracks. In the anthropological materials, however, no traces were found of war injuries, which are not exceptional in the Great Moravian cemeteries. The situation is analogous in the other cemeteries of the same date. Perhaps in this difference between the cemeteries from the seventh and eighth centuries and the ones from the ninth century we can look for some elucidation. Those men who fell in battle in the Slav–Avarian period were buried on the battlefield, but those who died during the Great Moravian period were carried away in order to be buried in the holy churchyard.

The paleodemographic characteristics of a cemetery will be completed by the paleopathological findings as well. I have mentioned the difference in the incidence of war injuries. It is interesting also that traces of tubercular inflammation have not yet been ascertained in the cemeteries from the seventh and eighth centuries, while in cemeteries from later times these traces are found regularly, even though they may be isolated. We could give no further differences in paleopathological findings, but we must be very careful about drawing conclusions, because the fact that some kinds of changes were not found does not mean that they did not occur in the original population.

To paleodemographic research belongs the task of appraising the number of inhabitants in the nearby dwelling-places. However, here it depends very much on the character of the dwelling-place, and then also we must take into account the fact that only an insignificant number of cemeteries could be excavated. The excavated graveyards from the seventh and eighth centuries seem to correspond in extent to dwelling-places of some 150 inhabitants, while in the Great Moravian period there are two types of dwelling-places: on the one hand, there are villages with approximately fifty citizens; and on the other hand, there are great centers, townlike in character, with several separate cemeteries whose expanse seems to indicate the presence of some hundreds of persons.

Paleodemographic research can certainly elucidate many questions

about the society of the early Middle Ages. In the depositories of our institutions there are now new materials from recent excavations which have not yet been evaluated from this point of view, so we can hope for an enlargement of our knowledge in this area.

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1966 *Staroslovanské pohřebiště v Josefově*. Prague: Academia.

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1966 "Etude anthropologique des anciens Slaves de Moravie," in *Investigations archéologiques en Tchécoslovaquie*. Edited by J. Filip, 253–254. Prague: Academia.

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1966 Anthropologie der Slawen aus dem Gräberfeld in Nové Zámky. *Slovenská Archeológia* 14, 167–204.
1971 Antropologie raněstředověkého pohřebiště v Abrahámu. *Sborník Národního Muzea v Praze* 27:57–131.

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APPENDICES

Abstracts

See also the following abstracts from the IXth International Congress of Anthropological and Ethnological Sciences, Chicago, 1973. These abstracts can be found in *Plan of the Congress and Résumés of Contributions* and *Supplement I.*

RECENT POPULATIONS

T. I. ALEKSEEVA. "Territorial morpho-functional studies in the U.S.S.R." (0004).

D. BLANCHARD et al. "Etude anthropologique d'une population de tendance endogame dans une vallée montagneuse des Pyrénées françaises" (1680).

R. A. CARTWRIGHT. "The genetics of Holy Island, Northumberland" (0029).

H. DUMITRESCU. "Multi-disciplinary anthropological investigations into the human quasi-isolates in the 'Pottile de Fier' [Iron Gates] micro-region" (0619).

A. W. ERIKSSON. "Anthropogenetic studies among Lapps" (0068).

Z. GAVRILOVIĆ. "Cranio-facial indexes in Serbs and Albanians" (0079).

T. D. GLADKOVA, T. A. TOTH. "Dermatoglyphics of Hungarians" (0081).

H. L. HEET. "Dermatoglyphics of the peoples of the U.S.S.R. in connection with their origin" (0094).

P. MARQUER, L. JACOBI. "Contribution à l'étude de l'endogamie en France" (0975).

J. NEMESKÉRI. "Population genetical research in eastern Hungary" (0156).

S. M. TSIOLI. "The Walachians of Thessaly in comparison to other neighbouring non-Walachian groups" (1379).
A. VALLS. "The blood group system X_g in a sample of Spaniards" (0024).

PREHISTORIC POPULATIONS

P. BOEV. "Über den Ursprung der dinarischen Rasse" (0017).
D. T. DAVIDE, R. R. GRILLETTO. "Determination of the discriminant function between three samples of Egyptian, Etruscan, and Roman skulls" (0054).
M. D. GARRALDA. "The Neolithic and Chalcolithic population of the Iberic peninsula" (0078).

Directory of European Anthropological Institutions: An Inquiry Promoted by the European Anthropological Association

AUSTRIA

Vienna

Anthropologische Abteilung des Naturhistorischen Museums, Burgring 7, 1014 Wien
Founded in 1924
Director: J. Szilvassy
Staff: P. Spindler, H. Kritscher
Main interests: Physical anthropology: anatomy, osteology, anthropometry, dermatoglyphics, genetics, population genetics, paleoanthropology

Institut für Humanbiologie der Universität Wien, Van Swietengasse 1, 1096 Wien
Founded in 1913
Staff: E. Reuer, G. Aue-Hauser, H. Seidler, M. Nicola, E. Winkler
Main interests: Physical anthropology: osteology, anthropometry, dermatoglyphics, paleoanthropology, morphology, variability

BELGIUM

Brussells

Institut Royal des Sciences Naturelles de Belgique, Section d'Anthropologie et de Préhistoire, Rue Vautier 31, Bruxelles 4
Founded in 1866
Director: F. Twiesselmann
Staff: A. Leguebe, S. Vrydagh-Laoureux et al.

Main interests: Physical anthropology: human evolution, growth and development, dermatoglyphics, biostatistics, population genetics

Laboratory of Anthropo-biology, Free University of Bruxelles, Institute of Sociology, Avenue Jeanne 44, 1050 Bruxelles
Directors: J. Hiernaux and J. Sporcq
Main interests: Physical anthropology: demography, population structure, ergonomics, anthropometry

Vrije Universiteit Brussel, Faculteit der Wetenschappen, Algemene Dierkunde, Pleinlaan 2, 1050 Brussel
Director: C. Susanne
Main interests: Physical anthropology: growth and development, anthropometry and ergonomics, cytogenetics

Leuven

Katholike Universiteit te Leuven, Labor. voor Prehistorie, Instituut voor Aardwetenschappen, Redingenstraat 16 bis, 3000 Leuven
Director: P. Vermeersch
Main interests: Prehistory, geology of Quaternary

Laboratoire de Paléontologie des Vertébrés et de ‚Paléontologie humaine, Université Catholique de Louvain, 3 Place Louis Pasteur, 1348 Louvain-La-Neuve
Founded in 1974
Director: E. Boné
Staff: A. Thoma
Main interests: Physical anthropology: paleoanthropology, human paleontology, fossils

BULGARIA

Plovdiv

Department of Anatomy and Physiology, Plovdiv University "P. Hilendarski", "Tzar Assen" 24, Plovdiv
Founded in 1961
Director: I. Petrov
Staff: At. Tachev, M. Nikolova, M. Batchvarova
Main interests: Physical anthropology: anatomy, physiology

Department of Anatomy, Histology and Embriology, Higher Medical Institution, D. Blagoev str. 9, Plovdiv
Founded in 1945
Director: I. Georgiev

Staff: S. Pavlov, D. Karapetrov, M. Tzirovski
Main interests: Physical anthropology: anatomy, growth and development, osteology

Sofia

Institute of Morphology, Bulgarian Academy of Sciences, Sofia
Founded in 1955
Director of the Institute: J. V. Goranov
Director, Section of Ethnical Anthropology: P. Boev
Staff: L. Christova, N. Kondova, V. Vulcheva, Zl. Filtcheva, Sl. Tcholakov
Main interests: Physical anthropology, growth and development, paleoanthropology, ecology, adaptation, paleodemography, dental anthropology, biometry
Director, Section of Applied Anthropology: St. Mutafov
Staff: S. Tornyova, A. Naceva, V. Kuzmova, El. Lilova, E. Lazarova
Main interests: Anthropometry and ergonomics, dermatoglyphics
Laboratory of Cytogenetics and Genetics
Staff: L. Caceva, E. Kryrochieva
Main interests: Genetics, twins

University of Sofia, "Klement Ochridssky", Department of Cytology, Histology, Embryology, and Anthropology, Laboratory of Anthropology, Faculty of Biology, 49 rue Muskovska, Sofia
Founded in 1971
Director of the Department: S. Stefanov
Prov. Director, Laboratory of Anthropology: P. Boev
Staff: Zv. Minkov
Main interests: Physical anthropology: growth and development, dental anthropology, paleoanthropology

Department of Archivistics, Faculty of History, Sofia
Cabinet of Anthropology: Lecturer: P. Boev

CZECHOSLOVAKIA

Bratislava

Department of Anthropology, Faculty of Natural Sciences, Comenius University, Sasinkova 4/b, 801 00 Bratislava
Founded in 1961
Director: M. F. Pospišil
Staff: M. Drobná, V. Ferák, E. Spevarová, Z. Kroupová, D. Sivaková, V. Perecková, M. Cvicelová, J. Cernaj, A. Korbacová, L. Lehotska

Main interests: Physical anthropology: anatomy, osteology, growth and development, anthropometry, ergonomics, dental anthropology, dermatoglyphics, genetics and cytogenetics, immunology–molecular biology–hematology, ecology, population genetics, physiology, biomathematics, biochemistry

Brno

Anthropos Institute, Moravian Muzeum, nam. 25. unora 7, 659 35 Brno
Founded in 1950
Director: J. Jelínek
Staff: K. Valoch,
Main interests: Physical anthropology: paleoanthropology, human paleontology, fossils, prehistory, paleopathology, Paleolithic archeology, Pleistocene environment

Institute of Anthropology, Department of Biology of Animals and Man, Faculty of Sciences, J. E. Purkyne University, 600 00 Brno
Founded in 1921
Director: A. Lorencová
Staff: V. Beneš
Main interests: Physical anthropology: osteology, growth and development, anthropometry and ergonomics, dermatoglyphics, population genetics, demography-population structure, paleoanthropology, human paleontology, fossils, prehistory, paleontology.

Section of Medical Anthropology, Department of Anatomy, Medical Faculty, J. E. Purkyne University, 600 00 Brno
Founded in 1971
Director: M. Dokládal
Staff: M. Hamplova
Main interests: Physical anthropology: anatomy, osteology, growth and development, dental anthropology

Olomouc

Anatomical Institute, Medical Faculty, Palacký University, S. Allenda 3, 772 00 Olomouc
Founded in 1945
Director: V. Holibka
Staff: A. Holibková, M. Černý, P. Lisonek
Main interests: Physical anthropology: anatomy, osteology, growth and development, genetics and cytogenetics, adaptation, anthropometry and ergonomics

Zoological and Anthropological Institute, Natural History, Palacký University, Leniniva 26, 770 00 Olomouc

Founded in 1945
Director: L. Crhák
Staff: J. Riegerová, Z. Glabazná
Main interests: Physical anthropology: anatomy, osteology, growth and development, anthropometry and ergonomics, dermatoglyphics, immunology-molecular biology-hematology, ecology, adaptation

Department of Children Biology and School Hygiene, Faculty of Education, Palacký University, Zerotinova 2, 770 00 Olomouc
Founded in 1961
Director: J. Klementa
Staff: S. Reiterová, J. Šmiřák, L. Krejcovsky, J. Stig, R. Prochazká, V. Ruhosová
Main interests: Physical anthropology: growth and development, population genetics, ergonomics.

Prague

Department of Human Biology and Medical Sciences, Charles University, Faculty of Education, Rettigové 4, 116 39 Praha
Founded in 1950
Director: H. Malá
Staff: J. Fiser, M. Hajnišova, J. Machová, J. Gutvirth, J. Fiserová, A. Skokanová, V. Sedivy
Main interests: Physical anthropology: growth and development, applied anthropology

Anthropological Department, National Museum, Václavské nám. 68, 115 79 Praha
Founded in 1967
Director: M. Stloukal
Staff: E. Vlček, H. Hanáková
Main interests: Physical anthropology: anatomy, osteology, growth and development, anthropometry and ergonomics, dental anthropology, paleopathology, paleoanthropology, human paleontology, fossils

Anthropological Department, Charles University, Faculty of Natural History, Vinicna 7, 120 00 Praha
Founded in 1908
Director: C. Troniček
Staff: S. Titlbachová, K. Hajniš, B. Skavarilová, H. Ziamalová, J. Bružek, B. Mejsnarová, V. Blazek, J. Leontovycová, B. Vachová
Main interests: Physical anthropology: anatomy, osteology, growth and development, anthropometry and ergonomics, dental anthropology, dermatoglyphics, genetics and cytogenetics, ecology, adaptation, population genetics, demography-population structure, paleodemog-

raphy, epidemiology; ethology and behavior, paleoecology, paleoanthropology, human paleontology, fossils

Anthropological Section of the Institute of Hygiene and Epidemiology, Srobarova 48, 10042 Praha 10
Founded in 1954
Director: M. Prokopec
Staff: D. Padevětová
Main interests: Physical anthropology: growth and development, osteology, anthropometry and ergonomics, dermatoglyphics, demography, population structure, paleodemography, paleopathology

Trnava

Department of Anthropology and Somatopathology, Faculty of Education, Comenius University, Generála L. Svobodu 34, 917 2Y Trnava
Founded in 1967
Director: I. Drobný
Staff: J. Slezaková, E. Chovanová, M. Hlatká
Main interests: Physical anthropology: anatomy, growth and development, medical anthropology

DENMARK

Copenhagen

Laboratory of Physical Anthropology, Norre Alle 63, 2100 Copenhagen Ø
Director: J. B. Jørgensen
Staff: O. Vagn Nielsen,
Main interests: Physical anthropology: growth and development, adaptation, physiology, prehistory

FINLAND

Oulu

Department of Ophthalmology, University of Oulu, Kajaanintie 50, 90220 Oulu 22
Director: H. Forsius
Main interests: Physical anthropology: adaptation, physiology, ophthalmology

FRANCE

Caen

Laboratoire d'Anthropologie et Paléopathologie, Faculté de Medecine, Université de Caen, 14032 Caen
Founded in 1959
Director: J. Dastugue
Staff: L. Buchet, B. Lecacheux, J. Desechalliers, G. Blin
Main interests: Physical anthropology: paleoanthropology, paleopathology

Paris

Laboratoire d'Anthropologie biologique, Université Paris VII, Tours 15–16, 2 Place Jussieu, 75230 Paris
Founded in 1960
Director: G. Olivier
Staff: F. Demoulin, P. Marquer
Main interests: Physical anthropology

Equipe d'Ecologie humaine, Université Paris VII, Laboratoire d'Anthropologie biologique, Tours 15–16, 2 Place Jussieu, 75005 Paris
Founded in 1971
Responsable: J. Hiernaux
Staff: E. Crognier, S. Krukoff, H. Pagezy, M. Pereira
Main interests: Physical anthropology: ecology, adaptation, physiology

Laboratoire d'Anthropologie biologique, Ecole Pratique des Hautes Etudes, 1 rue René Panhard, 75013 Paris
Founded in 1867 by P. Broca
Director: D. Ferembach
Main interests: Physical anthropology: growth and development, adaptation, physiology, paleoanthropology, paleodemography

Centre de Recherches Anthropologiques, Laboratoire d'Anthropologie biologique, démographique et génétique, Ecole Pratique des Hautes Etudes, Musée de l'Homme, Place du Trocadero, Paris
Founded in 1959
Director: R. Gessain
Staff: M. Gessain, J. R. Lamblin, M. T. de Lestrange, L. Jakobi, B. Robbe, C. Enel, D. Fouchier, M. Perrot, H. R. Plénot

Centre de Recherches Anthropologiques, Section de Paléoanthropologie, Musée de l'Homme, Place du Trocadero, Paris
Director: Y. Coppens
Staff: J. L. Heim, F. Rovillé-Sausse

Main interests: Physical anthropology: paleoanthropology

Institut National d'Etudes Démographiques, Département de génétique de population, 27 Rue du Commandeur, 75675 Paris, Cedex 14
Founded in 1945
Director: G. Callot
Chef du Département: A. Jacquard
Main interests: Physical anthropology: population genetics

Laboratoire de Paléontologie des Vertebrés et de Paléontologie humaine, 4 Place Jussieu, Tour 25, 75230 Paris
Director: R. Hoffstetter
Staff: E. Genet-Varcin, L. de Bonis, B. Vandermersch, B. Badré, D. Ambroise, P. Tassy; CNRS researchers: J. Perrot, B. Keraudren, S. Krukoff, M. Lechevallier, G. Dollfus, Ph. Janvier, I. Cl. Rage, E. Buffeteau, A. M. Tillier
Main interests: Primatology: paleoprimatology. Vertebrate paleontology. Physical anthropology: human paleontology

Laboratoire d'Anatomie comparée du Muséum, 55 Rue de Buffon, 75005 Paris
Founded in 1802 by G. Cuvier
Director: J. Anthony
Main interests: Primatology: anatomy. Physical anthropology: human paleontology

Lille

Laboratoire de Craniologie comparée (E.R. 93 du CNRS), Faculté libre de Medecine, 56 Rue du Port, 59046 Lille
Founded in 1950 by A. Delattre
Director: R. Fenart
Staff: R. L. A. Deblock, Destombes
Main interests: Primatology: anatomy, paleontology

Marseille

Laboratoire d'Anthropologie et d'Ecologie humaine, Université d'Aix-Marseille II, Faculté de Médecine, 27 Bd Jean-Moulin, 13005 Marseille
Director: H. de Lumley
Staff: M. A. de Lumley, C. Bouville, J. P. Charpy
Main interests: Physical anthropology: paleontology, prehistory, paleopathology, ecology

Laboratoire de Paléontologie humaine et de Préhistoire, Université de Provence, Centre Saint Charles, Place Victor Hugo 13331 Marseille

Director: H. de Lumley
Staff: M. A. de Lumley, J.-C. Miskovsky, J. R. Miskovsky, A. Tavoso, C. Bouville
Main interests: Physical anthropology: paleoanthropology, human paleontology, fossils, paleoecology, palinology, prehistory, dating techniques, chronology

Talence

Laboratoire d'Anthropologie, Université de Bordeaux 1, Cours de la liberation, 33400 Talence
Founded in 1970
Director: R. Riquet
Staff: J. G. Gauthier, A. Debénath
Main interests: Physical anthropology: paleoanthropology, ergonomy, skin anthropology, ethnology

Toulouse

Laboratoire d'Anthropologie physique du Collège de France et de l'Ecole des Hautes Etudes en Sciences Sociales
C.H.U. Purpan, 31300 Toulouse
Founded in 1972
Director: J. Ruffié
Main interests: Physical anthropology: immunology, molecular biology, hematology, genetics, population genetics, ecology, adaptation. Primatology: immunology, cytogenetics

Centre d'Hemotypologie, CNRS, C.H.U. Purpan, Av. de Grande-Bretagne, 31300 Toulouse
Founded in 1962
Director: G. Larrouy
Main interests: Physical anthropology: immunology, hematology, molecular biology, cytogenetics, genetics, population genetics, ecology, adaptation, physiology

EAST GERMANY

Berlin

Bereich Anthropologie des Museums für Naturkunde an der Humboldt-Universitat zu Berlin, Charlottenstrasse 19, 108 Berlin
Director: H. Grimm

Lehrgebiet Anthropologie, Technische Universitat, Franklinstrasse 29, 1000 Berlin 10
Director: L. Block

Jena

Institut für Anthropologie und Humangenetik, Friedrich Schiller — Universität, Kollegiengasse 10, 6900 Jena
Director: H. Bach

WEST GERMANY

Berlin

Institut für Anthropologie, Freie Universität, Fabeckstrasse 15, 1000 Berlin 33
Director: E. C. Büchi
Main interests: Physical anthropology, anthropometry and ergonomics

Bochum-Querenburg

Arbeitsgruppe für Funktionelle Morphologie, Universität, Buscheystrasse MA/07/551, 4630 Bochum-Querenburg
Director: H. Preuschoft
Main interests: Primatology, human evolution

Braunschweig

Seminar für Anthropologie Techn. Universität, Konst.-Unde-Str. 3, Postfach 3329, 33 Braunschweig
Director: G. Kurth
Staff: E. May
Main interests: Paleoanthropology, population biology, morphology, demography, paleodemography

Bremen

SB 3 Biologie (Anthropologie), Universität, Achterstr., 2800 Bremen
Director: H. Walter
Staff: E. Tsiakalos
Main interests: Physical anthropology: genetics and cytogenetics, immunology, molecular biology, hematology, population genetics, anthropometry and ergonomics

Frankfurt

Arbeitsgruppe Humanbiologie, FB Biologie, Universität, Siesmayerstr. 70, 6000 Frankfurt
Director: R. Protsch

Staff: H. Fleischhacker (Emer.), G. Lange
Main interests: Physical anthropology: paleoanthropology, human paleontology, fossils, dating techniques, chronology

Section of Paleoanthropology, Senckenberg-Museum, Senckenberg Anlage, 6 Frankfurt/Main
Director: G. H. R. von Koenigswald
Staff: J. Franzen
Main interests: Physical anthropology: paleoanthropology, human paleontology, fossils, prehistory. Primatology: paleoprimatology, fossils

Freiburg

Institut für Anthropologie und Humangenetik, Universität, Albertstr. 11, 7800 Freiburg
Director: U. Wolf
Staff: K. Gerhardt (Emer.), K. Bender, H. Brehme
Main interests: Physical anthropology: dermatoglyphics, genetics and cytogenetics, immunology, molecular biology, hematology, paleoanthropology, human paleontology, fossils

Giessen

Anthropologisches Institut, Justus Liebig-Universität, Wartweg 49, 6300 Giessen
Director: U. Schaefer
Staff: M. Kunter, B. Keil
Main interests: Physical anthropology: osteology, paleoecology, paleoenvironment, paleoanthropology, human paleontology, fossils, paleopathology

Göttingen

Lehrstuhl für Anthropologie, Universität, Burgerstr. 50, 3400 Göttingen
Director: C. Vogel
Staff: B. Hermann, R. Lorenz, H. Rothe
Main interests: Primatology: ecology, behavior, ethology, social organization. Physical anthropology

Hamburg

Anthropologisches Institut, Universität, Von Melle Park 10, 2000 Hamburg 13
Founded in 1933 by W. Scheidt
Director: R. Knussmann

Staff: R. Knussmann, H. Kneiphoff, V. P. Chopra, G. Bräuer, A. Schumacher
Main interests: Physical anthropology, primatology, biostatistics

Heidelberg

Institut für Anthropologie und Humangenetik, Universität, Mönchhofstrasse 15 A, 69 Heidelberg
Director: F. Vogel
Main interests: Physical anthropology: determination of paternity

Kiel

Anthropologisches Institut, Universität Kiel, Neue Universität, Olshausenstrasse 40–60, 2300 Kiel
Founded in 1923 by O. Aichel
Director: H. W. Jürgens
Staff: I. Matzdorff
Main interests: Physical anthropology: anthropometry and ergonomics, growth and development, demography, population structure. Primatology: taxonomy

Mainz

Anthropologisches Institut, Johannes Gutenberg — Universität, Saarstr. 21, 6500 Mainz
Founded in 1946 by Egon Freiherr v. Eickstedt
Director: W. Bernhard
Staff: I. Schwidetzky (Emeritus), E. Schleiermacher, W. Henke, W. Beck, F. Langenscheidt, L. Eckes, N. Xirotiris, H. Roth-Lutra, E. Schollmeyer
Main interests: Physical anthropology: osteology, growth and development, anthropometry and ergonomics, dental anthropology, dermatoglyphics, genetics and cytogenetics, demography, population structure, paleodemography, psychology, paleoanthropology, human paleontology, fossils

München

Institut für Anthropologie und Humangenetik, Universität, Richard Wagner Str. 10, 8000 München 2
Founded in 1886 by Johannes Ranke
Director: H. Cleve
Staff: G. Ziegelmayer, F. Schwarzfischer
Main interests: Physical anthropology: osteology, anthropometry and ergonomics, immunology, molecular biology, hematology

Anthropologische Staatssammlung, Theresienstr. 41, 8000 München 2
Staff: P. Schrötter, O. Röhrer-Ertl

Percha

Arbeitsgruppe Humanethologie, Max Planck Institut fur Humanethologie, Enzianweg, 8136 Percha
Director: I. Eibl-Eibesfeldt
Staff: B. Hold
Main interests: Ethology and behavior

Tübingen

Institut für Anthropologie und Humangenetik der Universität Tübingen, Schloss
Founded in 1932 by W. Gieseler
Director: H. Ritter
Staff: E. Haberlandt, J. Schmitt, A. Czarnetzki (osteological collection), I. Tillner et al.
Main interests: Population genetics, primate serology, physical anthropology: prehistoric physical anthropology

Ulm

Lehrstuhl für Anthropologie, Universität, am Hochsträss 8
Founded in 1973
Director: H. Baitsch
Staff: F. W. Rösing
Main interests: Physical anthropology: osteology, anthropometry and ergonomics, genetics and cytogenetics, adaptation, population genetics, paleodemography, ethology and behavior, paleoanthropology, human paleontology, fossils

GREAT BRITAIN

Aberdeen

Dept. of Anatomy, University of Aberdeen, Marischal College, Aberdeen AB9 1AS
Director: E. J. Clegg
Staff: M. F. Bruce, A. E. Abelson
Main interests: Physical anthropology: osteology, growth and development, anthropometry and ergonomics, ecology, adaptation, population genetics, demography, population structure, paleoanthropology, prehistory

Guildford

Department of Human Biology and Health, University of Surrey, Guildford GU2 5XH
Founded in 1966
Director: P. R. Davis
Staff: R. J. Howland, S. Santana De Sa, D. Stubbs, L. Hawkins, C. J. Turner, C. Hyman, J. Smith, H. Wood
Main interests: Physiology, anatomy, genetics, dermatoglyphics, behavior

London

Department of Growth and Development, Institute of Child Health, University of London, 30 Guilford Street, London WC1
Founded in 1956
Director: J. M. Tanner
Staff: N. Burton Jones, M. A. Preece, M. O. Savage, B. S. Carter, N. Cameron, A. Holder
Main interests: Physical anthropology: growth and development

Department of Human Biology, Chelsea College, Manresa Road, London SW3 6LX
Director: E. C. Grant
Staff: A. H. Bittles, L. Fraser
Main interests: Physical anthropology: genetics and cytogenetics, epidemiology, ethology and behavior, physiology

Galton Laboratory, University College London, Wolfson House, 4 Stephenson Way, London NW1 2HE
Founded in 1933
Director: Cedric A. B. Smith
Staff: M. S. Deol, D. P. Brenton, M. K. Lucas, J. D. A. Delhanty, U. Mittwoch, H. Kalmus, H. Gruneberg, W. Landauer
Main interests: Physical anthropology: genetics and cytogenetics, population genetics

Department of Anthropology, University College London, Gower Street, London WC1E 6BT
Founded in 1945 by D. Forde
Director: A. Strathern
Staff: L. Aiello, F. L. Brett, D. A. Coleman, T. R. Olson, H. Weymes
Main interests: Primatology: anatomy, osteology, paleoprimatology, genetics, taxonomy. Physical anthropology: anatomy, immunology, molecular biology, ecology, adaptation, population genetics, demography, epidemiology, paleoanthropology. Cultural anthropology: archaeology, food habits, nutrition

Oxford

Department of Physical Anthropology, 58 Banbury Road, Oxford OX1 3QX
Founded in 1976
Director: G. A. Harrison
Staff: A. J. Boyce, V. Reynolds
Main interests: Physical anthropology: ecology, demography–population structure, ethology and behavior

Newcastle upon Tyne

Department of Human Genetics, The University, 19 Claremont Place, Newcastle upon Tyne NE2 4AA
Founded in 1966 by D. F. Roberts
Director: D. F. Roberts
Staff: S. S. Papiha, J. E. Bernal, E. V. Davison, T. Andrews, C. K. Creen
Main interests: Physical anthropology: growth and development, anthropometry and ergonomics, dermatoglyphics, genetics and cytogenetics, immunology, molecular biology, hematology, adaptation, population genetics, demography, population structure

GREECE

No anthropological institutions, only anthropological associations

HUNGARY

Budapest

Department of Anthropology, Natural History Museum, Bajza u. 39, Budapest 1062
Founded in 1945
Director: T. Toth
Staff: S. Wenger, B. I. Pap, M. Ferencz
Main interests: Physical anthropology: paleoanthropology, taxonomy, odontology, dermatoglyphics, anthropometry

Department of Anthropology, "Eotvos Lorand" University, Puskin u. 3, 1088 Budapest
Founded in 1881
Director: G. O. Eiben
Staff: Gy. Gyenis, B. E. Bodzsar

Main interests: Physical anthropology: anthropometry and ergonomics, human growth and development, human genetics, dermatoglyphics

Department of Archaeology, Hungarian National Museum, Muzeum krt. 14/16, 1088 Budapest
Founded in 1825
Director: F. Fulep
Staff: K. Z. Zoffmann
Main interests: Historical anthropology

Demographic Research Institute, Central Statistical Office, Veres P. u. 10, 1053 Budapest
Founded in 1962
Director: K. Tekse
Staff: J. Nemeskéri
Main interests: Physical anthropology: paleodemography, paleoecology, population genetics, demography, population structure

Archaeological Research Institute, Hungarian Academy of Sciences, Uri u. 49, 1250 Budapest
Founded in 1958
Director: L. Gerevich
Staff: I. Lengyel, I. Kiszely
Main interests: Physical anthropology: paleoserology, historical anthropology

Debrecen

Department of Anthropology, "Kossuth Lajos" University, 4010 Debrecen
Founded in 1937
Director: J. Nemeskéri
Staff: M. K. Szilagyi, M. Papp
Main interests: Physical anthropology: anthropometry and ergonomics, growth and development, population genetics, demography, population structure, dermatoglyphics, immunology

Kecskemet

Museum of "Katona Jozsef," 6000 Kecskemet
Staff: Gy. Henkey
Main interests: Physical anthropology: anthropometry

Nyiregyhaza

Museum of "Josa Andras," 4401 Nyiregyhaza
Director: P. Nemeth

Staff: L. Szathmary
Main interests: Physical anthropology: historical anthropology, dynamics of human populations

Szeged

Department of Anthropology, "Jozsef Attila" University, Egyetem u. 2, 6722 Szeged
Founded in 1940
Director: P. Lipták
Staff: Gy. Farkas, B. M. Marcsik, A. Szenes
Main interests: Physical anthropology: paleoanthropology, human paleontology, growth and development, paleopathology, genetics and cytogenetics

Veszprem

Museum of "Bakony," 8201 Veszprem
Staff: K. K. Ery
Main interests: Physical anthropology: historical anthropology, paleodemography

ICELAND

Reykjavik

Institute of Anthropology, University of Iceland, Asvallagata 54, Reykjavik
Founded in 1975
Director: J. Pálsson
Main interests: Physical anthropology: growth and development, anthropometry, ergonomics, dermatoglyphics, population genetics, epidemiology, physiology, serology. Social anthropology

IRELAND

No anthropological institutions.

ITALY

Bologna

Institute of Anthropology, University, Via Selmi 1, 40126 Bologna

Founded in 1908 by G. Sergi
Director: F. Facchini
Staff: F. Martuzzi Veronesi, G. Gruppioni, P. Brasili Gualandi, E. Gualdi Russo, D. Pettener
Main interests: Physical anthropology: anthropometry, growth and development, human paleontology

Cagliari

Institute of Anthropological Sciences, University, Via G. T. Porcell 2, 09100 Cagliari
Founded in 1953 by C. Maxia
Director: G. Floris
Staff: G. G. Cosseddu, A. Fenu Usai, G. Lucia, G. Vona, G. Mameli
Main interests: Physical anthropology: anthropometry, hematology, human paleontology, archaeology

Camerino

Institute and Laboratory of Anthropology, University, Via F. Camerini 5, 62032 Camerino
Director: I. Testa-Bappenheim
Main interests: Physical anthropology: human paleontology, cytogenetics, dermatoglyphics, population genetics

Ferrara

Institute of Geology, Paleoethnology and Human Paleontology, University, Corso Ercole I d'Este 32, 44100 Ferrara
Director: A. Broglio
Staff: Cattani L, A. Guerreschi, C. Peretto, B. Sala
Main interests: Physical anthropology: human paleontology, paleoecology, palinology

Florence

Institute of Anthropology, University, Via del Proconsolo, 12, 50122 Firenze
Founded in 1869 by P. Mantegazza
Director: P. Graziosi
Staff: P. Messeri, E. Messeri, Q. Milanesi, E. Borzatti von Lovenstein, E. Pardini, C. Scarsini, C. Lombardi-Pardini, S. Ciruzzi Bartoli
Main interests: Human paleontology, ecology, paleoecology, ethnology

Genoa

Institute of Physical Anthropology, University, Via Balbi 4, 16126 Genova
Founded in 1972 by L. Brian
Director: L. Brian
Staff: C. Boggero, A. Guerci, E. Fumi, M. Priano, A. Scarpa
Main interests: Physical anthropology: anthropometry, growth and development, human biology

Messina

Institute of Anthropology, University, Via del Verdi 75, 98100 Messina
Founded in 1950 by F. Landogna-Cassone
Director: A. Segre
Staff: M. Piperno
Main interests: Physical anthropology, human paleontology, primatology

Naples

Institute of Anthropology, University, Via Mezzocannone 8, 80134 Napoli
Founded in 1880 by G. Nicolucci
Director: M. Galgano
Staff: C. D'Amore, M. Barbaro, Moraldo

Padua

Institute of Anthropology, University, Via Jappelli 1 A, 35100 Padova
Founded by E. Tedeschi
Director: G. Alciati
Staff: C. Corrain, M. A. Capitanio, G. Esparmer, A. Drusini
Main interests: Physical anthropology, human paleontology, paleopathology, ethnology

Pavia

Institute of Istology, Embryology and Anthropology, University, Piazza Botta 10, 27100 Pavia
Founded in 1914 by G. L. Sera
Director: M. G. Manfredi Romanini
Staff: D. Formenti, Ronchetti, N. Fraschini, G. Bernocchi, C. Pellicciari, L. Bolchi
Main interests: Physical anthropology, human biology, population genetics

Pisa

Institute of Anthropology and Human Paleontology, University
Founded in 1949 by R. Parenti
Director: A. Radmilli
Staff: C. Tozzi, F. Mallegni, R. Grifoni Cremonesi, G. Paoli, S. Borgognini Tarli, G. Radi, G. Formicola, C. Sorrentino, C. Pitti
Main interests: Physical anthropology, human biology, human paleontology, palethnology, ethnology

Rome

Institute of Anthropology, University, Città Universitaria, 00185 Roma
Founded in 1878 by G. Sergi
Director: V. Correnti
Staff: M. Cresta, G. De Stefano, P. Passarello, G. Spedini De Cicco, F. Vecchi, A. M. Di Majo, E. Cappucci, A. Coppa, G. Biondi
Main interests: Physical anthropology, human paleontology, ecology, human biology

Sassari

Institute of Anthropological Sciences, University, Viale Regina Margherita 15, 07100 Sassari
Director: F. Fedele
Main interests: Physical anthropology, anthropometry, human biology, prehistory

Siena

Institute of Anthropology and Human Paleontology, University, Via delle Cerchia 5, 53100 Siena
Director: A. Palma de Cesnola
Staff: S. S. Galiberti, P. Gambassini, F. Martini, A. Ronchitelli, L. Sarti-Martini
Main interests: Physical anthropology: human paleontology, paleoecology, palethnology

Institute of Anthropology, Faculty of Medicine, University, Via del Laterino 8, 53100 Siena
Director: V. Capecchi

Turin

Institute of Anthropology, University, Via Accademia Albertina 17, 10123 Torino
Founded in 1923 by G. Marro

Director: B. Chiarelli
Staff: M. Masali, F. Fedele, E. Rabino Massa, G. Ardito, L. Lamberti, D. Davide, P. Ponzetto, A. Mottura
Main interests: Physical anthropology: human paleontology, anthropometry, ergonomics, cytogenetics, population genetics, paleoecology. Primatology: cytogenetics, taxonomy

NORWAY

No anthropological institutions

THE NETHERLANDS

Amsterdam

Anthropogenetisch Instituut, Faculteit der Geneeskunde, van der Boekhorstraat 7, Postbus 7161, Amsterdam 1011
Director: A. W. Eriksson

Utrecht

Institute of Human Biology, State University Utrecht, Achter de Dam 24, Utrecht
Founded in 1959
Director: J. Huizinga
Main interests: Physical anthropology: population genetics, adaptation, physiology, growth and development

POLAND

Bialystok

Laboratory of Anthropology, Department of Anatomy, Medical Academy, Palac Branickich, Białystok
Founded in 1950
Director: T. Jelisiejew
Main interests: Physical anthropology: osteology, growth and development

Gdansk-Oliwa

Laboratory of Anthropology, College of Physical Education, ul. Wiejska 1, Gdańsk-Oliwa

Founded in 1974
Director: W. Berdychowski
Main interests: Physical anthropology: growth and development

Krakow

Anthropological Institute of the University of Krakow, ul. Krupnica 50, Kraków
Director: P. Sikora
Staff: B. Jasicki (Emer.), K. Kaczanowski

Department of Morphology, Academy of Physical Education, ul. Slowackiego 46, Kraków
Founded in 1954
Director: Z. Bochenska
Staff: S. Panek, M. Zielińska, S. Golab
Main interests: Physical anthropology: growth and development

Lodz

Laboratory of Anthropometry and Physiology, Institute of Leather Industry, ul. Zgierska 73, Lódź 11
Founded in 1965
Director: R. Luba
Main interests: Physical anthropology: growth and development

Department of Anthropology, Lódź University, ul. Nowopoludniowa 12/16, Lódź
Founded in 1948
Director: Z. Kapica
Staff: H. Stolarczyk, L. Rozbicka, I. Grabowska, M. Becker
Main interests: Physical anthropology: paleodemography, growth and development

Poznan

Department of Anthropology, University of Adam Mickiewicz, ul. Fredry 10, Poznań
Founded in 1924
Director: A. Malinowski
Staff: F. Wokroj, M. Godycki (Emer.), J. Strzalko, M. Henneberg
Main interests: Physical anthropology: paleodemography, growth and development, osteology

Department of Anthropology, Academy of Physical Education, ul. Marchlewskiego 27/39, Poznań
Founded in 1966

Director: Z. Drozdowski
Main interests: Physical anthropology, biorhythms, physical activity and body structure

Torun

Department of Anthropology, University of Mikolaj Kopernik, ul. Gagarina 9, Toruń
Founded in 1952
Director: G. Kriesel
Main interests: Physical anthropology: growth and development

Warsaw

Laboratory of Clinical Anthropometry, Department of Child Development, National Research Institute of Mother and Child, ul. Kasprzaka 17, Warszawa
Founded in 1958
Director: J. Kopczynska-Sikorska
Staff: R. Kurniewicz-Witczakowa, I. Miesowicz, M. Zdańska-Brincken
Main interests: Physical anthropology: child growth and development, endocrinological and pathological deviations in body structure

Laboratory of Somatology, Institute of Food and Nutrition, ul. Powsińska 61/63, Warszawa
Founded in 1970
Director: J. Charzewska
Main interests: Nutritional status and feeding patterns

Department of Anthropology, Academy of Physical Education, ul. Marymoncka 34, Warszawa
Founded in 1954
Director: M. Sklad
Staff: T. Laska-Mierzejewska
Main interests: Physical anthropology: growth and development, genetics

Laboratory of Paleopathology and Human Ecology, Department of Mediterranean Archaeology of the Polish Academy of Sciences
Palac Kultury i Nauki, Plac Defilad, Warszawa
Founded in 1963
Director: T. Dzierżykray-Rogalski
Staff: E. Promińska
Main interests: Physical anthropology: osteology; Africanistics

Department of Historical Anthropology, Warsaw University, ul. Krakowskie Przedmieście 26/28, Warszawa
Founded in 1960

Director: A. Wierciński
Main interests: Physical anthropology; Americanistics

Department of Ecology, Institute of Human Ecology of the Polish Academy of Sciences, ul. Nowy Świat 72, 00–330 Warszawa
Director: N. Wolański
Staff: D. Elżanowska, E. Koisprzak, R. Koziot, A. Siniarska, M. Szemik, H. Zaremba
Main interests: Human ecology, growth and development, population biology

Wroclaw

Department of Anthropology, Academy of Physical Education, ul. Banacha 11, Wrocław
Founded in 1946
Director: A. Janusz
Main interests: Physical anthropology

Department of Anthropology, Wroclaw University of B. Bierut, ul. Kuznicza 35, 50–951 Wrocław
Founded in 1965
Director: W. Stęślicka-Mydlarska
Staff: T. Krupiński
Main interests: Primatology: anatomy. Physical anthropology: paleoanthropology, genetics

Department of Anthropology of the Polish Academy of Sciences, ul. Kuznicza 35, 50–951 Wrocław
Founded in 1953 by J. Mydlarski
Director: T. Bielicki
Staff: P. Bergman, St. Gorny, J. Koniarek, H. Lebioda, B. Miszkiewicz, K. Sawicki, H. Szczotka, Z. Szczotkova, A. Waliszko, J. Wich et al.
Main interests: Physical anthropology: growth and development, genetics, anthropometry and ergonomics, physiology

PORTUGAL

Coimbra

Institutuo de antropologia, Faculdade de Ciênzas, Universidade de Coimbra
Director: vacant

Lisbon

Centro de Estudios de Antropobiologia da J.I.U. Museu Zoologico et Antropologico de Faculdade de Ciências, Av. Oscar Monteiro Torres 34, 1 Esq., Lisboa
Director: M. E. Almeida de Castro

Porto

Instituto de Antropologia "Dr. Mendes Corrêa", Faculdade de Ciênzias, Universidade do Porto
Director: A. Rozeira

ROMANIA

Bucharest

Medical Anthropology Laboratory, Institute of Endocrinology, 34 Bd. Avialitor, Bucureşti
Founded in 1964 by St. M. Milcu
Director: St. M. Milcu
Main interests: Physical anthropology: anatomy, genetics, anthropometry, dermatoglyphics

Institutul Victor Babes, Spl. Independentei 99–101, Bucureşti 35
Director: I. Moraru
Staff: V. Sahleanu, C. Rişcutia, V. Ghetie, T. Enăchescu, V. V. Caramelea, L. Georgian, C. Medesan
Main interests: Physical anthropology: immunology, molecular biology, cytogenetics, genetics. Social anthropology

Iaşj

Laboratory of Morphology and Anthropology, Universitatea, Calea 23 August, n. 11, 6600 Iaşj
Founded in 1925 by J. G. Botez
Director: O. Necrasov (Consulting Professor)
Staff: S. Haimovici, S. Antoniu, M. Stirbu
Main interests: Physical anthropology: population biology, paleoanthropology, paleodemography, archeozoology

Permanent Working Group on Human Ecology and Paleoanthropology of the Biological Center of Iaşj
Founded in 1958 by O. Necrasov
Director: M. Cristescu

Staff: D. Botezatu, M.-E. Roşca, A. Ţarcă
Main interests: Population ecology, growth and development, paleoanthropology

SPAIN

Barcelona

Departamento de Antropologia, Facultad de Biologia, Universidad de Barcelona, Plaza de la Universidad, Barcelona
Director: J. Pons
Staff: P. Moreno, J. Bertran Petit, D. Turbon, F. Luna, C. Garcia, M. Hernandez
Main interests: Physical anthropology: dermatoglyphics, demography, genetics, prehistory

Bilbao

Catédra de Antropologia, Biological Department of the University, Facultad de Ciencias, Apartado 644
Director: J. M. Basabe
Staff: R. Iturioz, L. Caro
Main interests: Prehistoric physical anthropology, population biology

Granada

Laboratorio de Antropologia, "F. Oloriz-Institute", Medical Faculty of the University
Director: M. Guirao-Gea
Staff: M. Botella, Ph. Sovich, M. Garcia Sanghez
Main interests: Prehistoric physical anthropology, population biology

Madrid

Departamento de Antropologia, Universidad Complutenses, Ciudad Universitaria, Madrid 3
Founded in 1882 by F. de las Barras de Aragon
Director: A. Valls
Staff: R. Grande, D. Garralda, A. Robles, M. Mesa, C. Bernis, R. Calderon
Main interests: Physical anthropology: hematology, osteology, growth and development, paleoanthropology, prehistorical anthropology

Oviedo

Departamento de Antropologia, Facultad de Ciencias, Universidad d'Oviedo
Director: J. E. Egocheage
Main interests: Population biology, dermatoglyphics

Sabadell

Instituto Provincial de Paleontologia, Escuela Industrial 23, Sabadell
Founded in 1970
Director: M. Crusafont-Pairò
Staff: J. M. Golpe
Main interests: Primatology: paleoprimatology

SWEDEN

Solna

Osteological Research Laboratory, Ulriksdals Kungsgard, 171 71 Solna
Founded in 1967
Director: T. Sjøvold
Staff: A.-B. Gejvall (Emer.)
Main interests: Physical anthropology: osteology, forensic osteology and applied techniques, paleopathology, prehistoric environment

SWITZERLAND

Geneva

Department of Anthropology, University of Geneva, 12 Rue Gustave-Revilliod, 1227 Acacias-Genève
Founded in 1919 by E. Pittard
Director: Marc-R. Sauter
Main interests: Physical anthropology: paleoanthropology, human paleontology, prehistory, archaeology, demography, population structure, ecology, population genetics

Zurich

Anthropologisches Institut, Universität, Künstlergasse 15, 8001 Zürich
Director: J. Biegert
Staff: W. Scheffrahn, D. Glaser
Main interests: Primatology: anatomy, osteology, reproductive physi-

ology and breeding, genetics, taxonomy. Physical anthropology: anthropometry and ergonomics, paleoanthropology, genetics and cytogenetics

TURKEY

Ankara

Department of Physical Anthropology, Faculty of Letters, Ankara University, Sihhiye, Ankara
Founded in 1930 by S. Kansu
Director: A. Saatçioglu
Staff: C. Sentuna
Main interests: Primatology: genetics. Physical anthropology: growth and development, anthropometry, ergonomics, population genetics

Department of Paleoanthropology, Faculty of Language, History and Geography, University of Ankara, Ankara
Chairman: E. Bostanci

Chair of Prehistory, Faculty of Letters, University of Ankara, Ankara
Founded in 1955 by I. K. Kokten
Director: Y. Yucel
Staff: I. Yalçinkaya, G. Soylu
Main interests: Physical anthropology: prehistory, paleoecology, palethnology

USSR

Alma Ata

Institute of History, Kazakh Acadmy of Sciences
Physical anthropology: O. Ismagulov

Dushanbe

Institute of History, Academy of Sciences, Dushanbe
Physical anthropology: T. Kijatkina

Kiev

Institute of Ethnography, Academy of Sciences, Department of Anthropology, Per 7, Kw 16 Kolomiewskij
Director: V. P. Djačenko

Leningrad

Institute of Ethnography, Department of Physical Anthropology, Leningrad
Director: T. Gochman

Minsk

Institute of History and Ethnography, Academy of Sciences, Department of Physical Anthropology, Minsk
Director: L. Tegako

Moscow

Institute of Anthropology, Academy of Sciences, Karl Marx Street 18, Moscow
Director: V. Vlastovskij

Institute of Ethnography, Academy of Sciences, Dept. of Physical Anthropology, Dmitrija Uljanova Street 19, Moscow V-36
Director: A. Zubov

Museum of Anthropology and Ethnography, Machovaja 11, Moscow
Director: V. P. Yakimov

Institute and Museum of Anthropology, Moscow State University, Prospect of Marx 18, Moscow
Director: V. P. Yakimov
Staff: M. Miklashevska, T. Alexeeva, et al.

Riga

Institute of History, Latvian Academy of Sciences, Riga
Physical anthropology: R. Denisova

Samarkand

Institute of Archaeology, Academy of Sciences, Samarkand
Physical anthropology: T. Hojaev

Tallinn

Institute of History, Estonian Academy of Sciences, Tallinn
Physical anthropology: K. Mark

Tbilisi

Institute of History, Georgian Academy of Sciences, Department of Physical Anthropology, Tbilisi
Director: M. Abdushelishvili

Wilna

Historical Institute of the Lithuanian Academy of Sciences, Antakalnio 95–15, Vilnius 232040
Physical anthropology: G. Česnis

YUGOSLAVIA

Ljubljana

Chair of Anthropology, Biotechnic. Faculty, University, Askerceva 12, 61000 Ljubljana
Founded in 1946 by B. Škerlj
Director: Z. Dolinar-Osole
Main interests: Physical anthropology: growth and development, anatomy

Novi Sad

Institute of Human Biology, Faculty of Medicine, University, Hajduk Velikova 12, Novi Sad
Founded in 1960 by Z. Gavrilović
Director: Z. Gavrilović
Staff: N. Stajic, V. Bozic, D. Palanacki, M. Petrov
Main interests: Physical anthropology: population genetics, paternity tests

Zagreb

Laboratory of Epidemiology and Anthropology, Institute for Medical Research and Occupational Health, Mose Pijade 158, 41001 Zagreb
Chairman of anthropological group: P. Rudan
Staff: D. Božičević, M. Gomzi, B. Macarol, Z. Pišl, N. Smolej, A. Sujoldžić, I. Škoinjarić
Main interests: Biological anthropology: population biology, medical anthropology

Biographical Notes

GINETTE BILLY. No biographical data available.

F. BRESSAC. No biographical data available.

LUIGI BRIAN (1915–) is Professor of Anthropology and Director of the Institute of Physical Anthropology, University of Genoa, Italy. His principal areas of interest are anthropometry, growth and development, and human biology. His publications include numerous articles and a book entitled *Il differenziamento e la sistematica umana in funzione del tempo.*

V. V. BUNAK (1891–) was Chief of a Research Team and Member of the Institute of Ethnography, Department of Anthropology, Academy of Sciences of the USSR, Moscow. His principal areas of interests include anthropology of Russian people, growth of the body and its parts, the laws of postnatal ontogeny especially of rural populations, anthropometry and anthroposcopy, origin of human races, origin of hominids, and mechanical and differential growth factors in human skull formations.

MARIANTONIA CAPITANIO (1940–) is on the staff of the Institute of Anthropology, University of Padua, Italy. Her principal areas of interest include physical anthropology of alpine and prealpine regions, osteology, and human paleontology and paleopathology.

M.-C. CHAMLA (1928–) is Maître de recherche at the CNRS, Laboratory of Anthropology, Musée de l'Homme, Paris. Her principal areas of interest are anthropology of pre- and protohistoric populations,

particularly in North Africa, biological variations in endogamous communities, and dermatoglyphics.

B. CHIARELLI (1934–) was born in Florence, Italy. He received degrees in natural sciences in 1957 and in biological sciences in 1960, and his Ph.D. in anthropology in 1964 and in general biology and zoology in 1965. From 1969 to 1979 he was Professor of Primatology at the University of Turin. He was also, from 1962, Director of the Institute and Museum of Anthropology. He is currently Professor of Anthropology at the University of Florence, Italy. His publications include works on comparative genetics, cytogenetics, and taxonomy of primates. He has been editor-in-chief of the *Journal of Human Evolution* since 1972.

CLETO CORRAIN (1921–) is Professor at the Institute of Anthropology, University of Padua, Italy. His primary interests are in osteology, physical anthropology, and ethnography. His publications include numerous articles and books among which are: *Il divenire biologico dell'Uomo* and *Documenti etnografici e folkloristici nei sinodi diocessani italiana* (with P. Zampini).

E. I. DANILOVA. No biographical data available.

R. DENISOVA is on the staff of the Institute of History, Physical Anthropology section, Latvian Academy of Sciences, Riga, USSR.

FIORENZO FACCHINI (1929–) is Professor and Director of the Institute of Anthropology, University of Bologna, Italy. His principal areas of interest are prehistory and protohistory, particularly of Italy, Emilia and Sicily, growth at adolescence, enzymatic polymorphisms and seriological studies in Italian populations, and the anthropology of the Chibcha, Colombia. He has published widely on all of these subjects.

F. G. FEDELE (1942–) is Research Director in Prehistory and Human Paleoecology at the Institute of Anthropology of University of Turin, Italy. He received his D.Sc. in natural sciences (anthropology) from Turin in 1969. Since 1966 he has carried out pioneering excavations and research projects in northwestern Italy and the Alps, focusing on "early Man" problems, Alpine adaptations, and the dynamics of human ecosystems. He has worked on the same topics and as a physical anthropologist in other North Italian areas; in 1975 he cooperated as Visiting Scholar with the Northern Yukon Research Programme sponsored by the University of Toronto. He taught human ecology and paleoecology at Columbia University in 1976, and is the author of a hundred publications. In

1978 he was appointed Professor of Anthropology and Director of the Institute of Anthropological Science at Sassari University, Sardinia, Italy.

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